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COMPLETED

FLOOD INSURANCE STUDY

ORIGINAL

TOWN OF HINGHAM, MASSACHUSETTS
PLYMOUTH COUNTY

JUNE 3, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 250268

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Flood Boundary and Floodway Map

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
TOWN OF HINGHAM, MASSACHUSETTS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Hingham, Plymouth County, Massachusetts, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by PRC Harris for the Federal Emergency Management Agency (FEMA), under Contract No. H-4776. This work was completed in July 1983.

1.3 Coordination

On March 22, 1978, the scope of the study and technical aspects of the study were explained at an initial Consultation and Coordination Officer's (CCO) meeting attended by representatives of FEMA, the Hingham Planning Board, the Selectmen, the Conservation Commission, the Building Commissioner, and PRC Harris (the study contractor). Further discussions were held with the Conservation Commission, the Highway Superintendent, and Perkins Engineering to discuss historic flooding, existing flood plain zones, high-water marks, culvert modifications, and the status of the study.

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High-water marks for the February 1978 storm were obtained from the U. S. Geological Survey (USGS) and the U. S. Army Corps of Engineers (COE). The COE also furnished tide gage records from Boston Harbor and Cape Cod Canal at Sandwich. The National Ocean Survey furnished Boston tide tables for many years of data. Pertinent information was also obtained from the Massachusetts Department of Commerce and Development and the Hingham Journal.

An intermediate CCO meeting was held on March 12, 1980, to review the progress of the study. Another intermediate CCO meeting was conducted on September 13, 1983. On November 20, 1984, the results of the study were reviewed at a final CCO meeting held with representatives of FEMA, the town, and the study contractor.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Hingham, Plymouth County, Massachusetts. The area of study is shown on the Vicinity Map (Figure 1).

Riverine flooding on the following streams was studied by detailed methods: the Weir River from Foundry Pond Dam to Free Street; the Crooked Meadow River from Free Street to Cushing Pond Dam; the Plymouth River from Cushing Pond to a point approximately 1,000 feet downstream of the upstream corporate limits; the Eel River from its confluence with the Plymouth River to a point approximately 600 feet upstream of Brewster Road; Accord Brook from a point approximately 2,100 feet downstream of Prospect Street to a point approximately 125 feet upstream of Main Street (State Route 228); Turkey Hill Run from its confluence with the Weir River to a point approximately 140 feet upstream of East Street; and Town Brook from a point approximately 40 feet upstream of the culvert to Hingham Harbor to a point approximately 1,200 feet upstream of South Street. Tidal flooding from Hingham Bay, Hingham Harbor, the Weir River, the Weymouth Back River, and Broad Cove was also studied by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through July 1988.

Fulling Mill Brook, Tower Brook, Cushing Pond, Fulling Mill Pond, Brewer Pond, Accord Pond, Triphammer Pond, Bear Swamp, Home Meadows, Bouve Pond, Bound Brook, the Old Swamp River, several unnamed areas and tributaries, and the remaining portions of the Plymouth River, the Eel River, Accord Brook, and Turkey Hill Run were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Town of Hingham.

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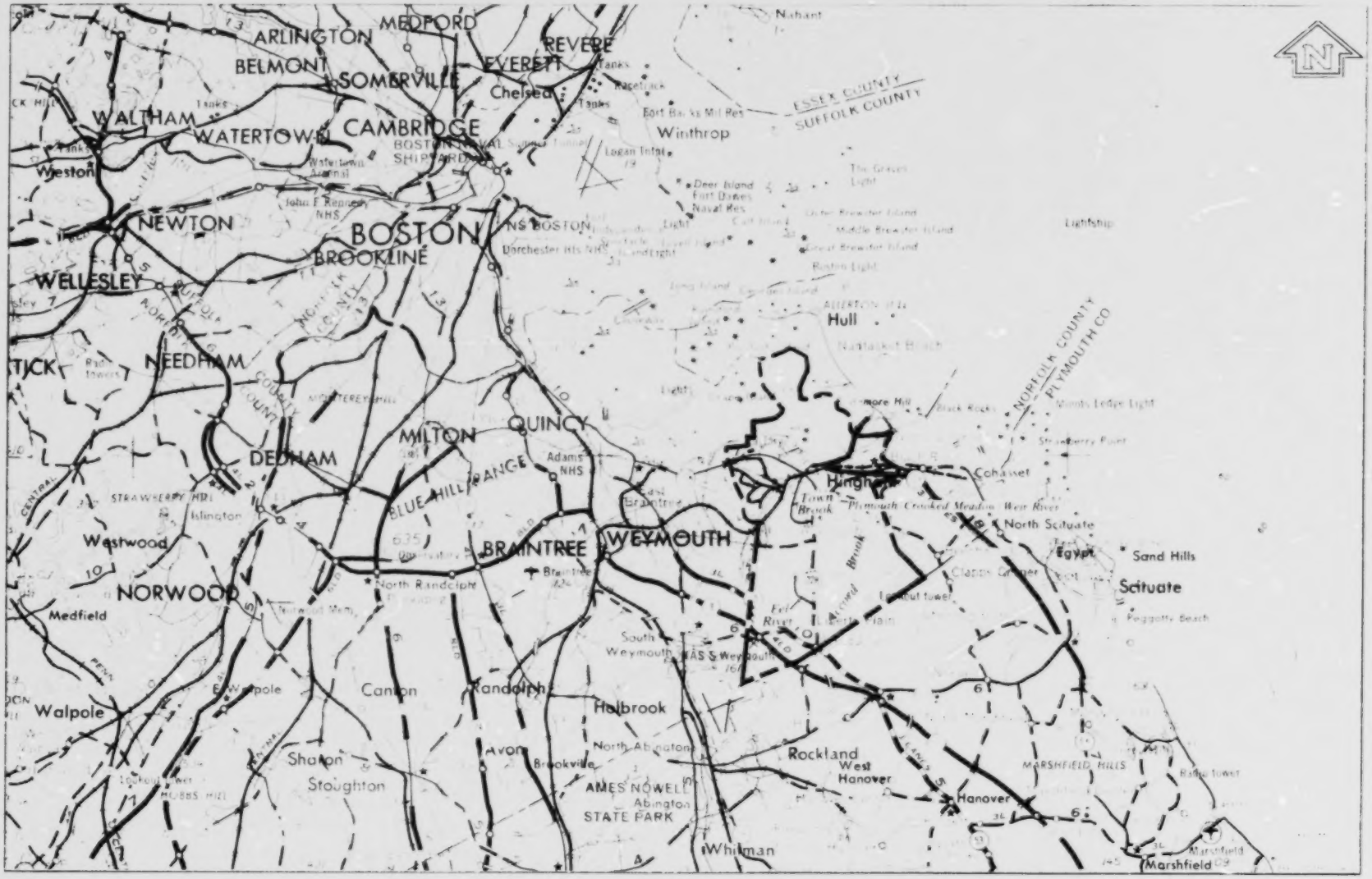

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA
(PLYMOUTH CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

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2.2 Community Description

The Town of Hingham is located in the northern portion of Plymouth County in eastern Massachusetts, approximately 15 miles southeast of the City of Boston. It is bordered by the Town of Hull to the north, the Town of Cohasset to the east, the Town of Scituate to the southeast, the Towns of Norwell and Rockland to the south, and the Town of Weymouth to the west. The total area contained within the corporate limits of Hingham is 22.6 square miles. According to the U. S. Bureau of the Census, the population of the town was 18,845 in 1970 (Reference 1). The projected 1990 population is 31,900, an increase of 69 percent over the 1970 figure.

Both residential and commercial development has occurred along much of the coastline. Commercial development in the town center has resulted in culverts and restrictions on much of Town Brook. Low density residential development has occurred along the other streams.

The terrain in Hingham is fairly level with some small hills of approximately 100 feet. Swampy areas are concentrated along the major watercourses, affording much natural floodwater storage area. Over 50 percent of Hingham is forested, including the Wompatuck State Park in the southeastern portion. Soils are a mixture of sandy loam with some wet and moist areas. Good textured soils are found in the southern and central sections, and rough and stony soils are found along the coast.

The climate of the town is moderate with temperatures ranging from a mean of 27 degrees Fahrenheit (°F) in January to a mean of 70.9°F in July. The average annual precipitation is 47.5 inches.

The Weir, Crooked Meadow, and Plymouth Rivers form the major drainage basin in Hingham. The Plymouth River originates in Weymouth and flows generally northeast to Cushing Pond. The Crooked Meadow River flows north from Cushing Pond to Free Street, and the Weir River flows north through Foundry Pond into Hingham Bay. The Eel River flows into the Plymouth River near Cushing Street. Accord Brook originates in Accord Pond and flows northeast. It drains part of Wompatuck State Park before flowing into the Weir River near Triphammer Pond. Town Brook orginates near Beal Street and flows east through a series of long culverts into Home Meadows. Turkey Hill Run flows from Hingham into Cohasset and back into Hingham, roughly parallel to State Route 228, before emptying into the Weir River.

The outer coastline is partially protected from wave action by Hull but is subject to storm surge flooding. The coastline is 18.5 miles long and includes several bays, the Weymouth Back River, Hingham Harbor, and the Weir River.

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The Weymouth Back River is tidal in Hingham and comprises the northern portion of the Hingham-Weymouth town boundary. Broad Cove, which originates near Broad Cove Road, is also tidal and is controlled by a tide gate into Hingham Harbor. The tidal portion of the Weir River begins at Foundry Pond Dam. A branch of the Weir River flows from Straits Pond along the Hingham-Hull corporate limits (Reference 2).

2.3 Principal Flood Problems

Due to its coastal New England location, Hingham is highly susceptible to northeasters. A northeaster travels southwest to northeast along the Atlantic coast, collecting moisture over the ocean and sending it inland via northeast winds. Northeasters differ from hurricanes in that they cover a larger area, have less intense winds, and move slower causing a longer duration. Where a hurricane may last for several hours, a northeaster may last for several days. For this reason, northeasters often last long enough to be accompanied by at least one high tide, which results in the most severe flooding conditions.

Areas which have flooded in Hingham include the neighborhood north of the Weir River and Rockland Street, the area west of Broad Cove, the coastline between the Weymouth Back River and Hingham Harbor, Free Street, and many areas near structures on the Weir, Crooked Meadow, and Plymouth Rivers.

In addition to flooding, damaging waves may result in areas with sufficient fetch length and water depth. It has been determined that three such areas exist in Hingham. One is the coastline extending from the outlet of the Weymouth Back River along the northern and northeastern coastlines of Hingham Harbor. The second is the eastern coastline of Worlds End and Planters Hill, while the third is the northern coastline of Bumkin Island. Although many other locations may be protected from wave attack, they are still vulnerable to inundation by storm surge. Some areas where this type of flooding has occurred are Rockland Street at the Hingham-Hull town boundary and at the intersection of Kilby and Rockland Streets.

Riverine flooding is also a major concern in Hingham. Due to Hurricane Diane in 1955, several roads crossing over the Weir, Crooked Meadow, and Plymouth Rivers were overtopped by 3 to 5 feet of floodwaters. These included Cushing Road, Leavitt Street, Union Street, Free Street, Main Street, and Ward Street. Additional flooding and undermining problems have occurred at various locations along Town Brook, which has many culverts.

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2.4 Flood Protection Measures

The tide gate at Broad Cove protects the area between Broad Cove Road and Thaxter Street from tidal inundation during the 100-year storm. Hingham maintains a flood plain district to prohibit future development within flood plain areas. The district is based on a flood plain map prepared by historic observations. This not only protects against flood damage to new structures, but also assures that the natural flood storage areas in the town will be protected.

Dams are located at Foundry and Cushing Ponds, but they do not provide flood control. A 2-foot high seawall protects part of the western shore of Hingham Harbor from storm surge and wave attack. Following Hurricane Diane in 1955, the Weir, Crooked Meadow, and Plymouth Rivers have been excavated from Leavitt Street to Main Street, and the culverts at Leavitt Street, Union Street, and Free Street have been replaced.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency and peak elevation-frequency relationships for the flooding sources studied in detail affecting the community.

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Peak discharges for the 10-, 50-, 100-, and 500-year floods in Hingham were computed by the USGS regional formula for estimating flood magnitude and frequency (Reference 3). This formula is based on an analysis of all gaging stations in eastern Massachusetts; the following equation is used:

$$Q_n = C_1 A^{C2} S^{C3}$$

where Q_n is the peak discharge for recurrence interval "n" in cubic feet per second, A is the drainage area, S is the stream slope and C_1, C2, and C3 are coefficients specific to recurrence interval "n".

A summary of drainage area-peak discharge relationships for the riverine streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
WEIR RIVER					
At Foundry Pond outlet	13.90	417	688	836	1,267
At the confluence of Accord Brook	7.52	266	442	538	821
At the confluence of Tower Brook	6.00	266	377	459	702
CROOKED MEADOW RIVER					
At the confluence of Fulling Mill Brook	4.31	177	297	362	556
PLYMOUTH RIVER					
At the confluence of the Eel River	3.31	150	252	307	474
At the confluence of Penniman Hill Tributary	1.41	81	137	168	262
EEL RIVER					
At its confluence with the Plymouth River	0.64	53	91	112	177
ACCORD BROOK					
At a point approximately 2,100 feet downstream of Prospect Street	3.09	125	210	256	393
TURKEY HILL RUN					
At its confluence with the Weir River	1.40	89	152	187	292

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TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
TOWN BROOK					
At a point approximately 40 feet upstream of the long culvert to Hingham Harbor	0.69	107	186	229	368
At the confluence of Baker Hill Tributary	0.31	11	24	31	58

Elevation-frequency relationships for the southeastern coast of Massachusetts have been determined through a Pearson Type III analysis of the tide gages at Boston Harbor (86 years of record) and the Cape Cod Canal entrance in Sandwich (21 years of record). These analyses showed that the February 1978 storm was approximately a 100-year event.

Elevations for the coast of Hingham were determined in conjunction with the Flood Insurance Study for the City of Boston (Reference 4). A detailed analysis of coastal flood elevations was prepared for the entire Boston Harbor from Hull to Nahant (Reference 5).

Flooding conditions in Hingham are caused by the passage of hurricanes and winter storms which are known as northeasters. Of these, the northeasters produce the more frequent and severe storm tides. Although subject to storm surges, Hingham is relatively protected against large waves by the presence of the Town of Hull. In most areas of Hingham, high-water levels will not be accompanied by high waves such as those experienced in Hull or Scituate.

Extreme flood levels in Hingham are caused by the combination of storm surges and high astronomical tides. Normal tides have a mean range of 9.5 feet and a spring range of 12 feet. Since these ranges are considerably higher than storm surges, the phasing of the tide and the storm is critical in the determination of flood elevations. Storm surges in Hingham are caused primarily by onshore winds and low barometric pressure, which occur during northeasters and hurricanes.

The following methodology was used for the entire Boston Harbor area, including Boston, Quincy, Weymouth, Hingham, and the inner coast of Hull to predict coastal flood elevations. A combined probabilistic-deterministic method was used in this study to develop the coastal flood elevations. This method was developed to allow the determination of accurate water-level elevations in locations where tidal gage records are

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not available. The probabilistic components of the study involved the determination of probabilities of occurrence of various meteorological parameters which define hurricanes and winter storms in the area. These probabilities are effectively constant over large regions and thus may be used at locations where no direct measurements have been made with no significant loss in accuracy. The deterministic component of the study involved the calculation of the storm surge which would be caused by various combinations of these meteorological parameters. The main steps involved in the determination of flood levels are as follows:

1. Determination of probabilities of occurrence of various meteorological parameters relevant to storm surge generation.

2. Development of numerical models to calculate the storm surge due to a particular set of meteorological conditions. Numerical models were developed to represent the outer coast, inner harbor and riverine areas.

3. Development of simple numerical models to allow rapid and inexpensive calculation of surge levels at various locations.

4. "Calibration" of the simple numerical model to specific locations of interest using the results of the more comprehensive numerical models.

5. Simulation of 500 years of storm tide data using a random generation of meteorological parameters based on their historical probabilities of occurrence and combination with a randomly phased astronomical tide.

6. Calculation of water level return periods on the basis of the simulated tide data.

A total of six numerical models were developed to calculate surge levels on the open coast and inside the harbor. These models included:

WINTSRG - used to determine the open coast surge due to winter storms.

HURSRG - used to determine the open coast surge due to hurricanes.

INSRG - used to determine the surge at various locations inside the harbor due to either winter storms or hurricanes using the output of WINTSRG or HURSRG as boundary conditions.

RIVSRG - used to determine the surge at various locations along the riverine sections due to either winter storms or hurricanes using the output of INSRG as boundary conditions.

WINTSEL - used to determine the total water level elevations due to the combination of astronomical tides and storm surges from winter storms for the development of 500 years of record.

HURSEL - used to determine the total water level elevations due to the combination of astronomical tides and hurricane surges for the development of 500 years of record.

The development of these models is discussed in detail in the Coastal Flooding Analysis (Reference 5). Briefly, the HURSRG, INSRG and RIVSRG models were developed based on the solution of the governing differential equations outlined by Dr. Robert Dean. The WINTSRG model was developed to account for the special conditions caused by winter storms which control the development of open coast surge levels. These models were used to develop surge time histories due to various combinations of the meteorological parameters which define the storms. Regression analyses were performed to determine the response of the harbor to each of the parameters while limiting the number of computer runs using the comprehensive numerical models required.

The WINTSEL and HURSEL models were developed to randomly generate winter storm and hurricane parameters respectively, and the resulting storm tides. The storm tides were calculated using simple numerical models based on the regression analyses performed using the comprehensive numerical models described above.

The numerical models were verified on the basis of historical storm records and the continuous recordings from the National Ocean Survey tidal gage located on Commonwealth Pier in Boston. Flood elevations for the February 1978 storm used to verify the models are shown in Table 2.

TABLE 2 - FEBRUARY 1978 FLOOD ELEVATIONS

Location	Elevation (NGVD)
At Crow Point in Hingham Harbor	11.71
On the Weir River in Hingham	8.92
At Pleasant Beach on Massachusetts Bay in Cohasset	13.09
At Little Harbor in Cohasset	10.89
At Rose Cliff in Hingham Bay in Weymouth	13.3
On Straits Pond-Massachusetts Bay in Hull	10.91

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For the tidal portion of the Weir River, the analyses were determined using a one-dimensional computer model. The model, RIVSRG, was developed in conjunction with the coastal analysis of Boston Harbor (Reference 5). Input to the model included physical characteristics of the estuary, the outer coastal surge hydrograph, and the one-year discharge from the freshwater portion of the river. Output consisted of a time series for each grid unit within the model.

For Broad Cove, the outer coastal surge hydrograph was combined with the hydraulic rating curve for the State Route 3A bridge. The resulting plot of flow versus time was then combined with a plot of elevation versus volume for the Broad Cove basin. It was found that the 100-year storm surge would inundate the area between State Route 3A, Lincoln Street, and Broad Cove Road, but would not flow over Broad Cove Road or through the one-way tide gate at Broad Cove Road. Thus, the area between Broad Cove Road and Thaxter Street will be inundated only by the 500-year storm.

The analyses reported in this study reflect stillwater elevations due to tidal and wind setup effects and include the contributions from wave action effects. The 10-, 50-, 100-, and 500-year stillwater elevations for Hingham Bay, the Weymouth Back River, Hingham Harbor, the Weir River, and Broad Cove are summarized in Table 3, "Summary of Stillwater Elevations."

TABLE 3 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
HINGHAM BAY				
At Bumpkin Island	9.5	10.4	11.1	11.6
From Hewitts Cove to Crow Point	9.9	10.8	11.3	12.1
WEYMOUTH BACK RIVER				
From Hewitts Cove to Stodders Neck	10.0	11.0	11.9	12.3
From Stodders Neck to Fort Hill Street	10.3	11.4	12.2	12.7
HINGHAM HARBOR				
At Bottom, Sailor, Ragged, and Langlee Islands	9.5	10.4	11.1	11.6
From Crow Point to Planters Hill	10.1	10.9	11.4	12.2

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TABLE 3 - SUMMARY OF STILLWATER ELEVATIONS - continued

FLOODING SOURCE AND LOCATION	ELEVATION (feet) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
WEIR RIVER				
From confluence with Hingham Bay to George Washington Boulevard	9.9	10.8	11.3	12.1
From George Washington Boulevard to Foundry Pond	10.2	11.1	11.6	12.4
BROAD COVE				
Entire shoreline	4.6	5.1	5.8	6.5

The effects of wave action were considered in the determination of flood hazard areas. Coastal structures that are located above stillwater flood elevations can still be severely damaged by wave runup, wave-induced erosion, and wave-borne debris. For example, during the northeaster of February 1978, considerable damage along the Massachusetts coast was caused by wave activity, even though most of the damaged structures were above the high-water level. The extent of wave runup past stillwater levels depends greatly on the wave conditions and local topography.

Wave heights and corresponding wave crest elevations were determined using the National Academy of Sciences (NAS) methodology (Reference 6). The wave runup was determined using the methodology developed by Stone and Webster Engineering Corporation for FEMA (Reference 7).

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analyses were field surveyed. Cross sections were located at close intervals upstream and downstream of bridges and culverts in order to compute the significant backwater effects in urbanized areas. Overbank extensions of field surveyed cross sections and additional sections needed for hydraulic continuity were taken from topographic maps at a scale of 1:4,800 with a contour interval of 5 feet (Reference 8). All bridges and culverts were field surveyed to obtain elevation data and structural geometry. For Town Brook, survey data were obtained from the Hingham Highway Department and a study on Town Brook (Reference 9). Because the survey was old, elevations were spot checked in the field, and some additional sections were surveyed.

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Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 10). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. The computer model for each stream was calibrated to account for historic records, which were obtained from interviews with local residents and the Hingham Flood Plain Map (Reference 11). Present culvert conditions were used, and recent modifications were taken into consideration in the use of historic high-water marks.

Starting water-surface elevations for the Weir River, the Crooked Meadow River, and the Plymouth River were taken from standard hydraulic analyses on Foundry Pond Dam. Starting water-surface elevations for the Eel River were determined assuming coincident peak flows with the Plymouth River. For Accord Brook and Town Brook, starting water-surface elevations were determined using normal depth calculations. Starting water-surface elevations for Turkey Hill Run were taken as the mean high tide at its outlet on Straits Pond.

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were determined by field observation and topographic maps compiled from aerial photographs (Reference 8). Assumptions for all hydraulic factors were checked by computations that duplicated historic flood profiles. The channel "n" and overbank "n" values for the streams studied by detailed methods are shown in the following tabulation:

Stream	Channel "n"	Overbank "n"
Weir River	0.014-0.050	0.080-0.120
Crooked Meadow River	0.014-0.050	0.080-0.120
Plymouth River	0.014-0.050	0.080-0.120
Eel River	0.015-0.050	0.090-0.120
Accord Brook	0.010-0.050	0.050-0.100
Turkey Hill Brook	0.015-0.070	0.090-0.110
Town Brook	0.017-0.050	0.070-0.100

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

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Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the tidal flooding sources studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the shorelines.

Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The COE has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones (Reference 12). The 3-foot wave has been determined as the minimum size wave capable of causing major damage to conventional wood frame or brick veneer structures.

A wave height analysis was performed to determine wave heights and corresponding wave crest elevations for the areas inundated by the tidal flooding. A wave runup analysis was performed to determine the height and extent of runup beyond the limit of tidal inundation. The results of these analyses were combined into a wave envelope, which was constructed by extending the maximum wave runup elevation seaward to its intersection with the wave crest profile.

The methodology for analyzing wave heights and corresponding wave crest elevations was developed by the NAS (Reference 6). The NAS methodology is based on three major concepts.

First, a storm surge on the open coast is accompanied by waves. The maximum height of these waves is related to the depth of water by the following equation:

$$H_b = 0.78d$$

where H_b is the crest to trough height of the maximum or breaking wave and d is the stillwater depth. The elevation of the crest of an unimpeded wave is determined using the equation:

$$Z_w = S_* + 0.7H_* = S_* + 0.55d$$

where Z_w is the wave crest elevation, S_* is the stillwater elevation at the site, and H_* is the wave height at the site. The 0.7 coefficient is the portion of the wave height which reaches above the stillwater elevation. H_b is the upper limit for H_*.

The second major concept is that the breaking wave height may be diminished by dissipation of energy by natural or man-made obstructions. The wave height transmitted past a given obstruction is determined by the following equation:

$$H_t = BH_i$$

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where H_t is the transmitted wave height, H_i is the incident wave height, and B is a transmission coefficient ranging from 0.0 to 1.0. The coefficient is a function of the physical characteristics of the obstruction. Equations have been developed by the NAS to determine B for vegetation, buildings, natural barriers such as dunes, and man-made barriers such as breakwaters and seawalls (Reference 6).

The third concept deals with unimpeded reaches between obstructions. New wave generation can result from wind action. This added energy is related to distance and mean depth over the unimpeded reach.

The methodology for analyzing wave runup was developed by Stone and Webster Engineering Corporation (Reference 7). The wave runup computer program operates using an ensemble of deepwater wave heights, H_i, the stillwater elevation, S*, a wave period, T_s, and beach slope, m. For Hingham, it was determined that predicted deepwater wave heights and associated wave period will not be sufficient to cause runup over 2 feet above the stillwater level.

These concepts and equations were used to compute wave envelope elevations associated with the 100-year storm surge. Accurate topographic, land-use, and land cover data are required for the coastal analyses. Maps of the study area, at a scale of 1:4,800 with a contour interval of 5 feet were used for the topographic data (Reference 8). Depths below mean low water were determined from National Ocean Survey Coastal Charts (Reference 13). The land-use and land cover data were obtained by field surveys and aerial photographs (Reference 14).

Wave heights and wave runup were computed along transects which were located perpendicular to the average mean shoreline. The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, the transects were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects. Figure 2, "Transect Location Map," illustrates the location of the transects for the community.

Along each transect, wave envelope elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. Between transects, elevations were interpolated using the topographic maps, land-use and land cover data, and engineering judgment to determine the areal extent of flooding. The results of the

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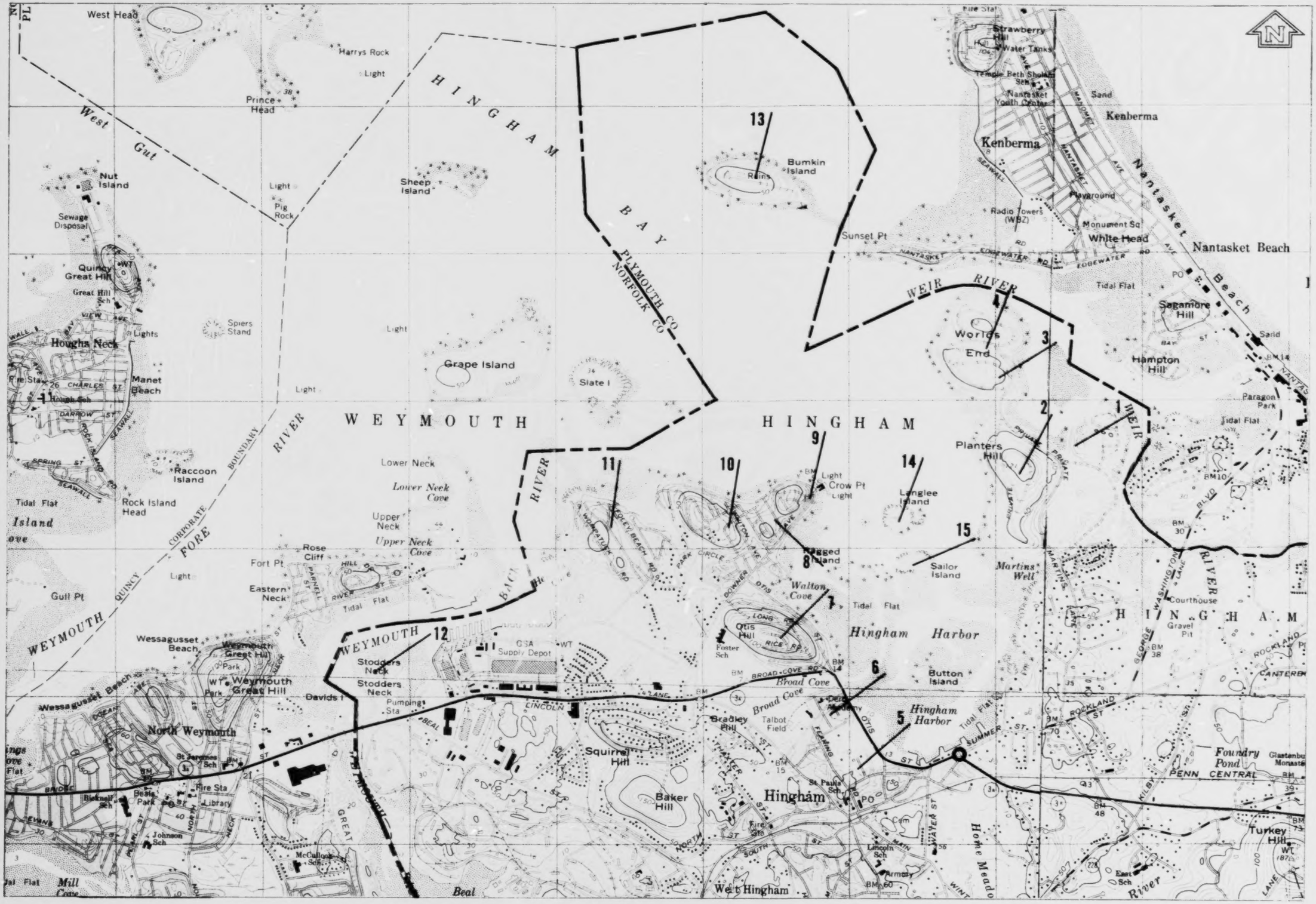

APPROXIMATE SCALE
1000 0 1000 2000 3000 FEET

TRANSECT LOCATION MAP

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA
(PLYMOUTH CO.)

FIGURE 2

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calculations are accurate until local topography, vegetation, or cultural development within the community undergo any major changes. Selected beach transects with stillwater elevations for the 10- and 100-year recurrence intervals and wave envelope profiles for the 100-year recurrence interval are shown on the Coastal Profiles (Exhibit 3).

Wave height and wave runup calculations were not performed on the west-facing coasts of Hingham because the peak storm surge elevation and peak storm winds will not occur simultaneously in this region.

All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For riverine streams, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (Reference 8).

For tidal areas without wave action, the 100-year and 500-year boundaries were delineated using the topographic maps referenced above (Reference 8). For the tidal areas with wave action, the flood boundaries were delineated using the elevations determined at each transect; between transects, the boundaries were interpolated using engineering judgment, land-cover data, and the topographic maps referenced above (Reference 8). The 100-year flood plain was divided into whole-foot elevation zones based on the average wave envelope elevation in that zone. Where the map scale did not permit these zones to be delineated at one foot intervals, larger increments were used.

For the areas studied by approximate methods, the boundary of the 100-year flood was delineated using the Hingham Flood Plain Map, the Flood Hazard Boundary Map for Hingham, and USGS topographic maps (References 11, 15, and 16).

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The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 4).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown. Portions of the floodway widths for Turkey Hill Run extend beyond the corporate limits.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 3.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Weir River								
A	0.020	371	1,408	0.6	15.7	15.7	15.7	0.0
B	0.141	13	74	11.2	15.7	15.7	15.7	0.0
C	0.300	18	99	8.5	19.6	19.6	19.6	0.0
D	0.319	63	336	2.5	20.6	20.6	20.6	0.0
E	0.336	36	278	3.0	21.7	21.7	21.7	0.0
F	0.370	41	310	2.7	21.8	21.8	21.8	0.0
G	0.395	48	151	5.5	22.5	22.5	22.5	0.0
H	0.448	25	234	3.6	23.5	23.5	24.3	0.8
I	0.467	53	383	2.2	23.7	23.7	24.5	0.8
J	0.755	130	750	1.1	24.2	24.2	25.0	0.8
K	1.087	50	411	2.0	24.5	24.5	25.4	0.9
L	1.283	22	214	3.9	26.3	26.3	27.2	0.9
M	1.302	52	477	1.8	26.6	26.6	27.4	0.8
N	1.510	171	1,177	0.7	26.7	26.7	27.6	0.9
O	1.718	215	1,477	0.6	26.8	26.8	27.7	0.9
P	1.815	130	930	0.6	26.8	26.8	27.7	0.9
Q	1.967	170	998	0.5	26.8	26.8	27.7	0.9
R	2.201	30	212	2.5	28.0	28.0	28.3	0.3
S	2.221	116	788	0.7	28.0	28.0	28.6	0.6
T	2.429	413	2,923	0.2	28.0	28.0	28.7	0.7

[1]Miles above Foundry Pond Dam

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA
(PLYMOUTH CO.)

FLOODWAY DATA

WEIR RIVER

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Crooked Meadow River								
U	2.608	34	235	1.9	29.2	29.2	29.6	0.4
V	2.627	44	351	1.3	29.3	29.3	29.7	0.4
W	2.892	35	224	1.6	29.3	29.3	29.8	0.5
X	3.108	9	60	6.0	32.0	32.0	32.0	0.0
Y	3.134	16	124	2.9	32.6	32.6	32.6	0.0
Z	3.323	13	118	3.1	32.7	32.7	33.5	0.8
Plymouth River								
AA	3.615	48	61	6.0	48.7	48.7	48.7	0.0
AB	3.804	50	639	0.6	49.3	49.3	49.3	0.0
AC	4.016	34	192	1.9	49.3	49.3	49.3	0.0
AD	4.315	71	178	1.7	49.7	49.7	49.8	0.1
AE	4.574	175	1,038	0.3	55.5	55.5	55.8	0.3
AF	4.593	46	383	0.8	55.5	55.5	55.8	0.3
AG	4.839	60	217	1.4	55.6	55.6	56.2	0.6
AH	4.983	24	101	3.0	58.4	58.4	58.5	0.1
AI	5.002	35	159	1.9	58.4	58.4	58.5	0.1
AJ	5.182	72	339	0.9	58.5	58.5	59.0	0.5
AK	5.400	70	242	1.3	58.8	58.8	59.5	0.7
AL	5.608	28	67	4.6	62.3	62.3	62.3	0.0
AM	5.627	94	309	0.5	62.7	62.7	62.7	0.0
AN	5.810	48	213	0.8	64.3	64.3	64.3	0.0
AO	5.829	113	320	1.7	64.3	64.3	64.3	0.0
AP	6.000	18	25	3.8	64.8	64.8	65.8	1.0

[1]Miles above Foundry Pond Dam

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA
(PLYMOUTH CO.)

FLOODWAY DATA

CROOKED MEADOW RIVER AND PLYMOUTH RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Eel River								
A	0.038	28	99	1.1	49.6	49.6	50.6	1.0
B	0.174	5	14	7.8	50.6	50.6	50.8	0.2
C	0.183	49	137	0.8	51.9	51.9	52.0	0.1
D	0.316	78	229	0.5	52.0	52.0	52.2	0.2
E	0.566	5	16	7.2	55.9	55.9	55.9	0.0
F	0.588	26	104	1.1	56.8	56.8	56.8	0.0
G	0.728	76	160	0.7	56.9	56.9	57.0	0.1
H	0.906	6	22	5.2	75.2	75.2	75.2	0.0
I	0.934	9	15	7.4	75.9	75.9	75.9	0.0
J	1.013	49	255	0.4	99.6	99.6	99.6	0.0
K	1.037	23	101	1.1	99.6	99.6	99.6	0.0
L	1.135	77	239	0.5	99.7	99.7	99.8	0.1
Accord Brook								
A	3.064	128	437	0.6	108.3	108.3	109.2	0.9
B	3.084	100	428	0.6	108.3	108.3	109.3	1.0
C	3.264	188	929	0.3	108.3	108.3	109.3	1.0
D	3.464	9	48	5.3	113.4	113.4	113.4	0.0
E	3.484	87	334	0.8	113.9	113.9	113.9	0.0
F	3.658	128	541	0.5	114.0	114.0	114.1	0.1
G	3.819	405	1,733	0.1	114.0	114.0	114.2	0.2
H	4.117	206	703	0.4	114.0	114.0	114.2	0.2

[1]Miles above confluence with Plymouth River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA
(PLYMOUTH CO.)

FLOODWAY DATA

EEL RIVER AND ACCORD BROOK

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Accord Brook (continued)								
I	4.329[1]	39	56	4.5	114.5	114.5	115.4	0.9
J	4.485[1]	128	338	0.8	116.8	116.8	117.8	1.0
K	4.731[1]	16	39	6.6	119.4	119.4	119.7	0.3
L	4.988[1]	92	382	0.7	125.2	125.2	125.3	0.1
M	5.007[1]	56	185	1.4	125.2	125.2	125.3	0.1
Turkey Hill Run								
A	0.068[2]	20	28	6.6	11.6	9.2[4]	9.2	0.0
B	0.093[2]	44	175	1.3	11.6	10.0[4]	10.0	0.0
C	0.144[2]	20	76	7.1	18.2	18.2	18.2	0.0
D	1.044[2]	880/150[3]	5,550	0.1	35.5	35.5	35.9	0.4
E	1.142[2]	102	410	0.5	35.5	35.5	35.9	0.4
F	1.161[2]	58	266	0.7	35.6	35.6	36.0	0.4
G	1.203[2]	142	1,564	0.1	38.9	38.9	39.0	0.1

[1]Miles above confluence with Plymouth River

[2]Miles above confluence with Weir River

[3]Width/width within corporate limits

[4]Elevation computed without consideration of backwater from Weir River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA
(PLYMOUTH CO)

FLOODWAY DATA

ACCORD BROOK AND TURKEY HILL RUN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Town Brook								
A	0.008	33	154	4.1	10.8	10.8	11.8	1.0
B	0.083	42	200	2.6	11.8	11.8	12.8	1.0
C	0.140	44	88	7.5	12.8	12.8	13.1	0.3
D	0.240	45	558	0.9	16.4	16.4	16.9	0.5
E	0.278	44	313	1.8	17.4	17.4	17.4	0.0
F	0.284	140	306	1.6	17.4	17.4	17.6	0.2
G	0.356	134	267	2.0	17.4	17.4	17.6	0.2
H	0.364	164	785	0.8	17.5	17.5	17.7	0.2
I	0.432	196	540	1.2	17.5	17.5	17.7	0.2
J	0.472	228	1,737	0.1	17.5	17.5	17.7	0.2
K	0.533	270	1,709	0.1	17.5	17.5	17.7	0.2
L	0.569	430	733	0.4	17.5	17.5	17.8	0.3
M	0.628	197	374	0.5	17.6	17.6	17.8	0.2
N	0.703	4	570	0.9	19.7	19.7	19.7	0.0
O	0.738	3	550	1.0	19.9	19.9	19.9	0.0
P	0.776	3	180	4.0	21.1	21.1	21.1	0.0
Q	0.878	12	26	1.2	22.4	22.4	22.5	0.1

[1]Miles above culvert to Hingham Harbor

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

FLOODWAY DATA

TOWN BROOK

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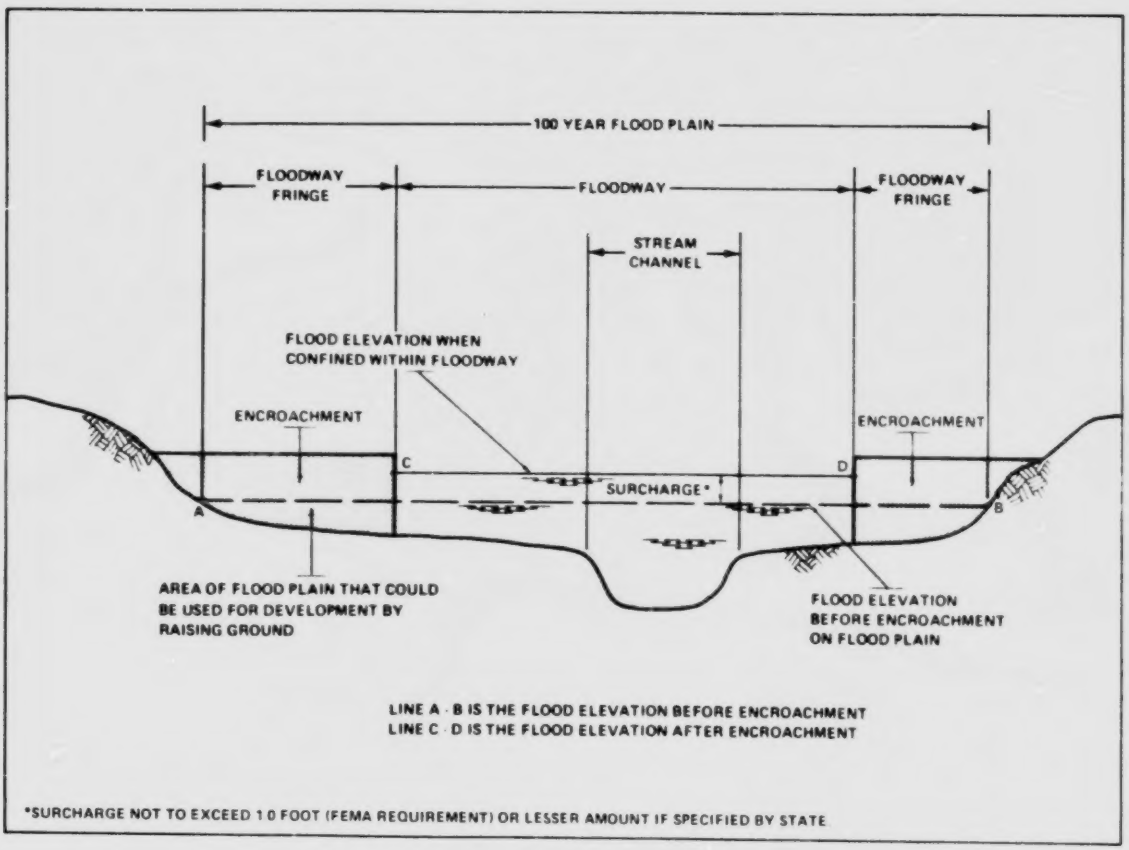
100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC Figure 3

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 4 for certain downstream cross sections of Turkey Hill Run are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

One aspect of floodway and flood plain encroachment is sometimes overlooked and more often neglected: the cumulative effect of encroachment on flood discharge magnitude. Generally, as encroachment occurs, temporary storage areas are lost, velocities increase, and the magnitude of the discharge increases. As floodwaters move downstream, that increase can become more significant. The combined effect of a narrower flood plain and greater discharge can, due to hydraulic effects alone, produce a flood stage that exceeds the anticipated 100-year flood.

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FEMA does not encourage the filling-in of the floodway fringe area. Local officials should be aware that even a 1-foot rise in the water-surface elevation can cause flooding in areas which would have received little or no flooding if such filling had not taken place. Careful consideration of the economic and human dislocation which will be caused by a rise in flood heights should be made before filling is allowed. Large quantities of fill in the fringe area could also disrupt the flood plain ecosystem, causing a major impact on local environmental resources.

Communities are encouraged by FEMA to adopt wider, more restrictive floodways and to minimize the amount of fill allowed in the fringe areas. Such actions also meet the intent of the Massachusetts Wetlands Protection Act (Massachusetts General Law, Chapter 131, Section 40). Under the provisions of the act, the local conservation commission and the Massachusetts Department of Environmental Quality Engineering have the authority to impose "orders of condition" regulating flood plain areas subject to flooding and wetland alterations. The orders normally require compensatory storage to replace any loss resulting from proposed flood plain alterations. "Compensatory storage" is the volume of flood plain storage which must be created for floodwater retention equalling the storage removed by alteration. Such requirements in flood plain areas are designed to minimize adverse effects on flood plain hydrology.

In order to achieve a unified flood plain and wetlands management program, numerous Massachusetts communities have adopted local zoning by-laws, ordinances, subdivision regulations, and local Board of Health regulations augmenting the minimum requirements of the Flood Insurance Program and the Wetlands Protection Act. FEMA encourages the use of this Flood Insurance Study as the technical basis for adoption of a broader, more encompassing local flood plain management program than is required to meet the minimum standards of the Flood Insurance Program.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail in the Town of Hingham.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following tabulation for more than 20 percent of the reach:

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Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the riverine flooding sources of the Town of Hingham are shown on the Flood Profiles (Exhibit 1) and summarized in Table 5A.

In areas where wave height and wave runup analyses were performed, reaches were determined for areas of the coastline, represented by a transect or group of transects, which have the same physical characteristics. For each transect the coastal high hazard zone (V zone) may be divided into two reaches to reflect those areas where wave runup is a dominant factor and those areas where wave runup does not dominate and elevations are determined by the wave height analysis. The reaches determined for the coastal flooding sources of the Town of Hingham are summarized in Table 5B.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequenc of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Weir River							
Reach 1	04,07	-2.9	-1.0	+1.5	030	A6	Varies
Crooked Meadow River							
Reach 1	07	-2.9	-1.0	+1.5	030	A6	Varies
Reach 2	07	-1.4	-0.5	+0.9	015	A3	Varies
Plymouth River							
Reach 1	07,08, 09,10	-1.4	-0.5	+0.9	015	A3	Varies
Reach 2	09,10	-0.5	-0.2	+0.4	005	A1	Varies
Eel River							
Reach 1	07,08, 10	-0.9	-0.3	+1.4	010	A2	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 5A

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA
(PLYMOUTH CO.)

FLOOD INSURANCE ZONE DATA

WEIR RIVER, CROOKED MEADOW RIVER, PLYMOUTH RIVER AND EEL RIVER

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Accord Brook							
Reach 1	08	-1.0	-0.4	+0.6	010	A2	Varies
Turkey Hill Run							
Reach 1	01	-2.0	-0.4	+0.6	020	A4	Varies
Reach 2	01	-3.4	-1.3	+1.0	035	A7	Varies
Town Brook							
Reach 1	07	-0.7	-0.3	+0.5	005	A1	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 5A

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA
(PLYMOUTH CO.)

FLOOD INSURANCE ZONE DATA

ACCORD BROOK, TURKEY HILL RUN AND TOWN BROOK

TABLE 5B - FLOOD INSURANCE ZONE DATA

Flooding Source	Stillwater Elevation 10-Year	Stillwater Elevation 100-Year	FHF	Zone	Base Flood Elevation (Feet NGVD)*
Hingham Bay	9.5	11.1	025	V5	13-15
			030	A6	11-13
			015	A3	11
	9.9	11.3	020	V4	13-15
			025	A5	11-13
			015	A3	11
Weymouth Back River	10.0	11.9	025	A5	12-13
			020	A4	12
	10.3	12.2	020	A4	12
Hingham Harbor	9.5	11.1	025	V5	13
			025	A5	11-13
	10.1	11.4	020	V4	13-14
			015	A3	11-13
Weir River	9.9	11.3	020	V4	13-14
			030	A6	11-13
			015	A3	11
	10.2	11.6	015	A3	12
Broad Cove	4.6	5.8	010	A2	6

*Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.

Zones A1, A2, A3, A4, A5, A6, and A7: Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.

Zones V4 and V5: Special Flood Hazard Areas along coasts inundated by the 100-year flood that have additional velocity hazards associated with waves of 3-foot amplitude or greater; with base flood elevations shown, and zones subdivided according to FHFs.

Zone B: Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other water control structure; areas

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Zone B (continued):	subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the community are shown in Tables 5A and 5B.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Hingham is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

Flood Insurance Studies for the Towns of Hull, Weymouth, Norwell, and Rockland have been completed (References 17, 18, 19, and 20). The results of this study are in exact agreement with the results of the Weymouth, Norwell, and Rockland studies. Base flood elevations between Hull and Hingham do not agree at the north side of World's End because wave height regeneration occurs between Sunset Point in Hull and World's End in Hingham.

Flood Insurance Studies for the Towns of Cohasset, and Scituate are currently being prepared (References 21 and 22). The results of those studies will be in exact agreement with the results of this study.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Regional Director, Region I Office, J. W. McCormack Post Office and Courthouse Building, Room 462, Boston, Massachusetts 02109.

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8.0 BIBLIOGRAPHY AND REFERENCES

1. U. S. Department of Commerce, Bureau of the Census, 1970 Census of Population, Number of Inhabitants, Massachusetts, Washington, D. C., U. S. Government Printing Office, 1971.

2. Commonwealth of Massachusetts, Department of Commerce and Development, Massachusetts Profile of Hingham, Boston, Massachusetts, 1975.

3. U. S. Department of the Interior, Geological Survey, Water Resources Investigations 77-39, Estimating the Magnitude and Frequency of Floods on Natural-Flow Streams in Massachusetts by S. W. Wandle, Jr., Washington, D. C., 1977.

4. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, City of Boston, Suffolk County, Massachusetts, Washington, D. C., October 1, 1981.

5. Harris-Toups Associates, Flood Insurance Study, Coastal Flooding Analysis, Boston, Massachusetts, Lake Success, New York, December 1977.

6. National Academy of Sciences, Methodology for Calculating Wave Action Effects Associated with Storm Surge, Washington, D. C., 1977.

7. Stone and Webster Engineering Corporation, Manual for Wave Runup Analysis, Coastal Flood Insurance Studies, Boston, Massachusetts, November 1981.

8. Avis Airmap, Inc., of Braintree, Massachusetts, Topographic Maps compiled from aerial photographs, Scale 1:4,800, Contour Interval 5 Feet: Town of Hingham, Massachusetts, 1979.

9. Commonwealth of Massachusetts, Department of Public Works, Report on Town Brook and Home Meadows, Hingham, Massachusetts, Boston, Massachusetts, March 1970.

10. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, October 1973.

11. Perkins Engineering, Inc., Zoning Map, Part B, Flood Plain and Watershed Protection District, 1975, Town of Hingham, Scale 1"=1,600', July 1975.

12. U. S. Army Corps of Engineers, Galveston District, Identifying Coastal High Hazard Zones, Galveston, Texas, June 1975.

BEST COPY AVAILABLE

13. U. S. Department of Commerce, Coast and Geodetic Survey, Boston Harbor Coastal Chart, #246, 37th Edition, February 10, 1973.

14. Geod Surveying and Aerial Mapping Corporation, of Oak Ridge, New Jersey, Aerial Photographs, Scale 1"=1,600': Town of Hingham, Massachusetts, 1982.

15. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Town of Hingham, Plymouth County, Massachusetts, October 15, 1976.

16. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 10 Feet: Weymouth, Massachusetts, 1971, Photorevised 1979; Cohasset, Massachusetts, 1974; Hull, Massachusetts, 1971; Nantasket Beach, Massachusetts, 1974.

17. Federal Emergency Management Agency, Flood Insurance Study, Town of Hull, Plymouth County, Massachusetts, Washington, D. C., May 2, 1983.

18. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Town of Weymouth, Norfolk County, Massachusetts, Washington, D. C., March 30, 1979.

19. Federal Emergency Management Agency, Flood Insurance Study, Town of Norwell, Plymouth County, Massachusetts, Washington, D. C., January 19, 1982.

20. Federal Emergency Management Agency, Flood Insurance Study, Town of Rockland, Plymouth County, Massachusetts, Washington, D. C., January 19, 1982.

21. Federal Emergency Management Agency, Flood Insurance Study, Town of Cohasset, Norfolk County, Massachusetts (Unpublished).

22. Federal Emergency Management Agency, Flood Insurance Study, Town of Scituate, Plymouth County, Massachusetts (Unpublished).

Chow, Ven Te, ed., Handbook of Applied Hydrology, New York, McGraw-Hill, 1964.

Perkins Engineering, Inc., Zoning Map, Part A, Town of Hingham, Massachusetts, Scale 1"=1,600', 1977.

The Hingham Journal, September 16, 1954; August 25, 1955; February 24, 1972; February 16, 1978.

Town of Hingham, Annual Report, Hingham, Massachusetts, 1976.

BEST COPY AVAILABLE

Town of Hingham, Planning Board, Rules and Regulations Under Subdivision Control Law, Hingham, Massachusetts, January 1, 1971.

Town of Hingham, Zoning Board, Zoning Bylaw, Hingham, Massachusetts, July 9, 1975, Revised September 24, 1976 and August 4, 1977.

U. S. Army Corps of Engineers, Coastal Research Engineering Center, Shore Protection Manual, Volumes I and II, Fort Belvoir, Virginia, 1977.

U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Users Manual, Davis, California, November 1976.

U. S. Army Corps of Engineers, New England Division, Annual Peak Tide Levels, Boston Harbor, Waltham, Massachusetts, Recorded 1848-1978.

U. S. Department of Commerce, Coast and Geodetic Survey, Tides, Monthly Means and Extremes, Cape Cod Canal, Sandwich, Massachusetts, 1955-1975, 1978.

U. S. Department of the Interior, Geological Survey, Flood of March 1968 in Eastern Massachusetts and Rhode Island, Boston, Massachusetts, 1970.

U. S. Department of the Interior, Geological Survey, Water Resource Data for Massachusetts, New Hampshire, Rhode Island and Vermont, Parts 1 and 2, Boston, Massachusetts, 1966-1976.

U. S. Department of the Interior, Geological Survey, Water-Supply Paper 1420, Floods of August-October 1955, New England to North Carolina, Washington, D. C., 1960.

U. S. Department of the Interior, Geological Survey, Water-Supply Paper 798, The Floods of March 1936, Part 1. New England Rivers, Washington, D. C., 1937.

U. S. Department of the Interior, Geological Survey, Water-Supply Paper 1901, Surface Water Supply of the United States, Part I. North Atlantic Slope Basins, Washington, D. C., 1961-1965.

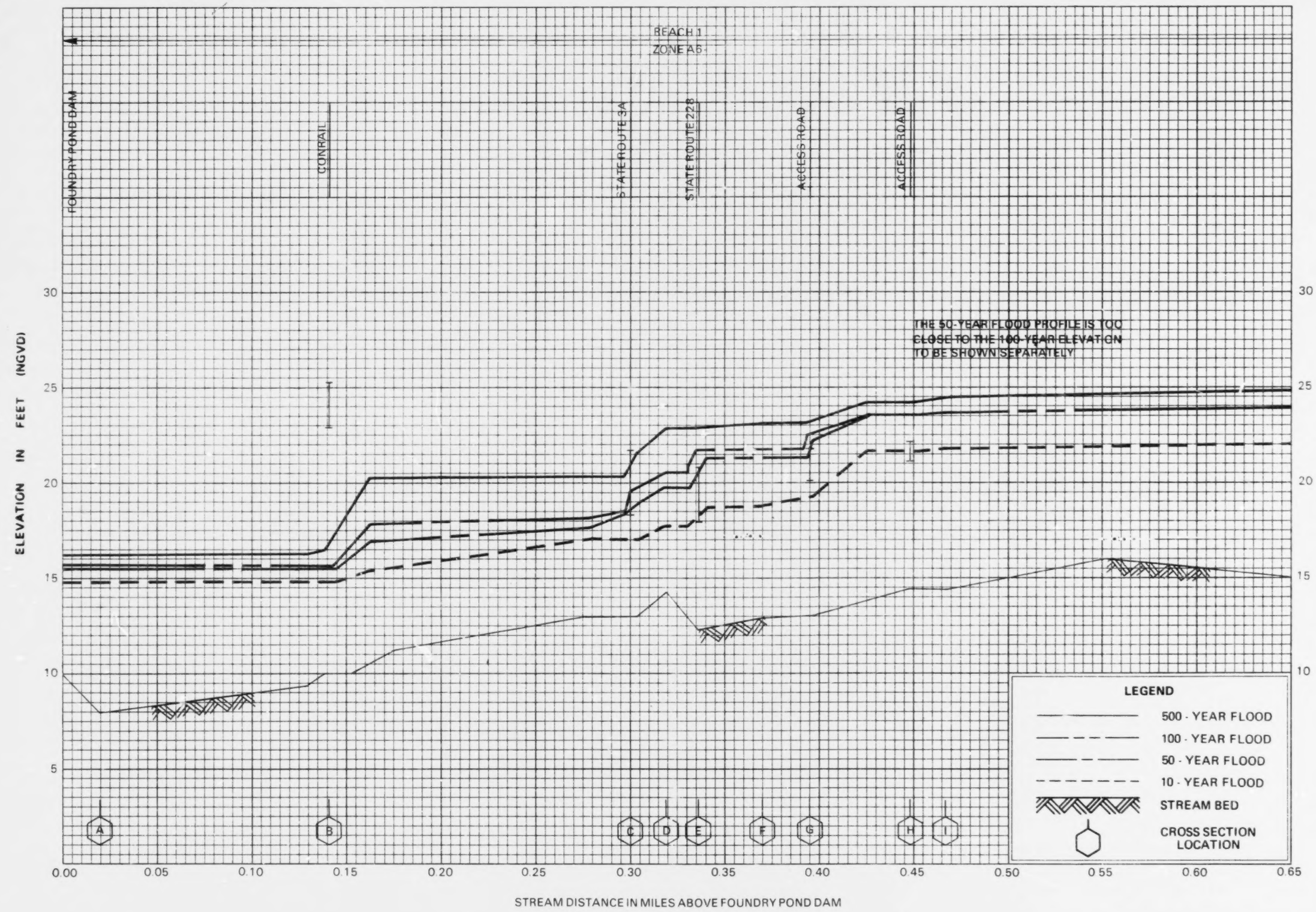
U. S. Department of the Interior, Geological Survey, Water-Supply Paper 1721, Surface Water Supply of the United States, Part I. North Atlantic Slope Basins, Washington, D. C., 1950-1960.

U. S. Department of the Interior, Geological Survey, Water-Supply Paper 1301, Surface Water Supply of the United States, Part I. North Atlantic Slope Basins, Washington, D. C., Prior to 1950.

Water Resources Council, "Guidelines for Determining Flood Flow Frequency", Bulletin 17, Washington, D. C., March 1976.

Whitman and Howard, Inc., Letter to the Hingham Conservation Commission, "Turkey Hill Run Culvert", Boston, Massachusetts, April 14, 1975.

BEST COPY AVAILABLE



FLOOD PROFILES

WEIR RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

01P

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REACH 1
ZONE A6

LEAVITT STREET

THE 50-YEAR FLOOD PROFILE IS TOO CLOSE TO THE 100-YEAR ELEVATION TO BE SHOWN SEPARATELY

ELEVATION IN FEET (NGVD)

30
25
20
15
10

0.65 0.70 0.75 0.80 0.85 0.90 0.95 1.00 1.05 1.10 1.15 1.20 1.25 1.30

STREAM DISTANCE IN MILES ABOVE FOUNDRY POND DAM

J K L

LEGEND

- 500 - YEAR FLOOD
- 100 - YEAR FLOOD
- 50 - YEAR FLOOD
- 10 - YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

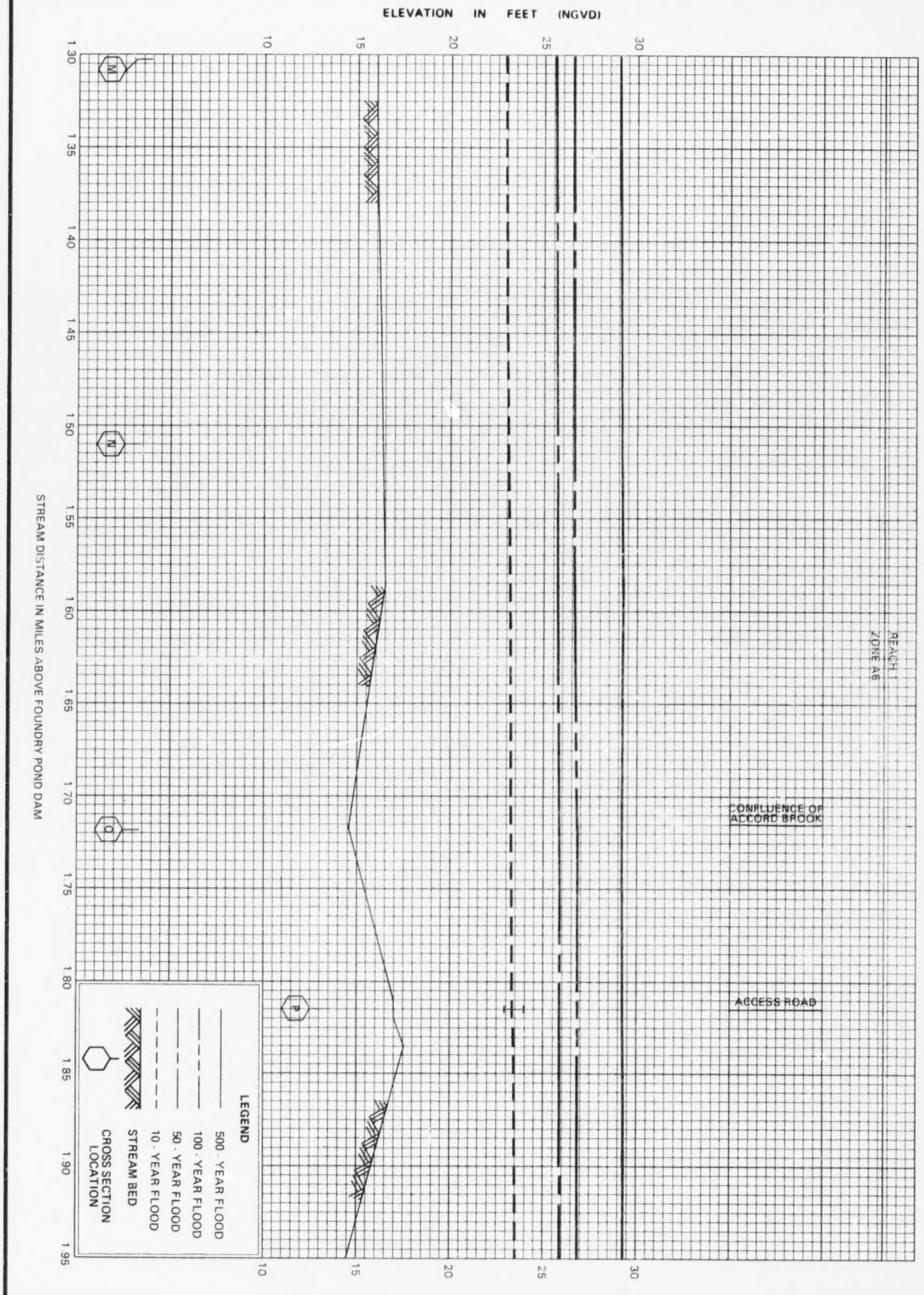
FLOOD PROFILES

WEIR RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA
(PLYMOUTH CO.)

02P



03P

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

FLOOD PROFILES

WEIR RIVER

37

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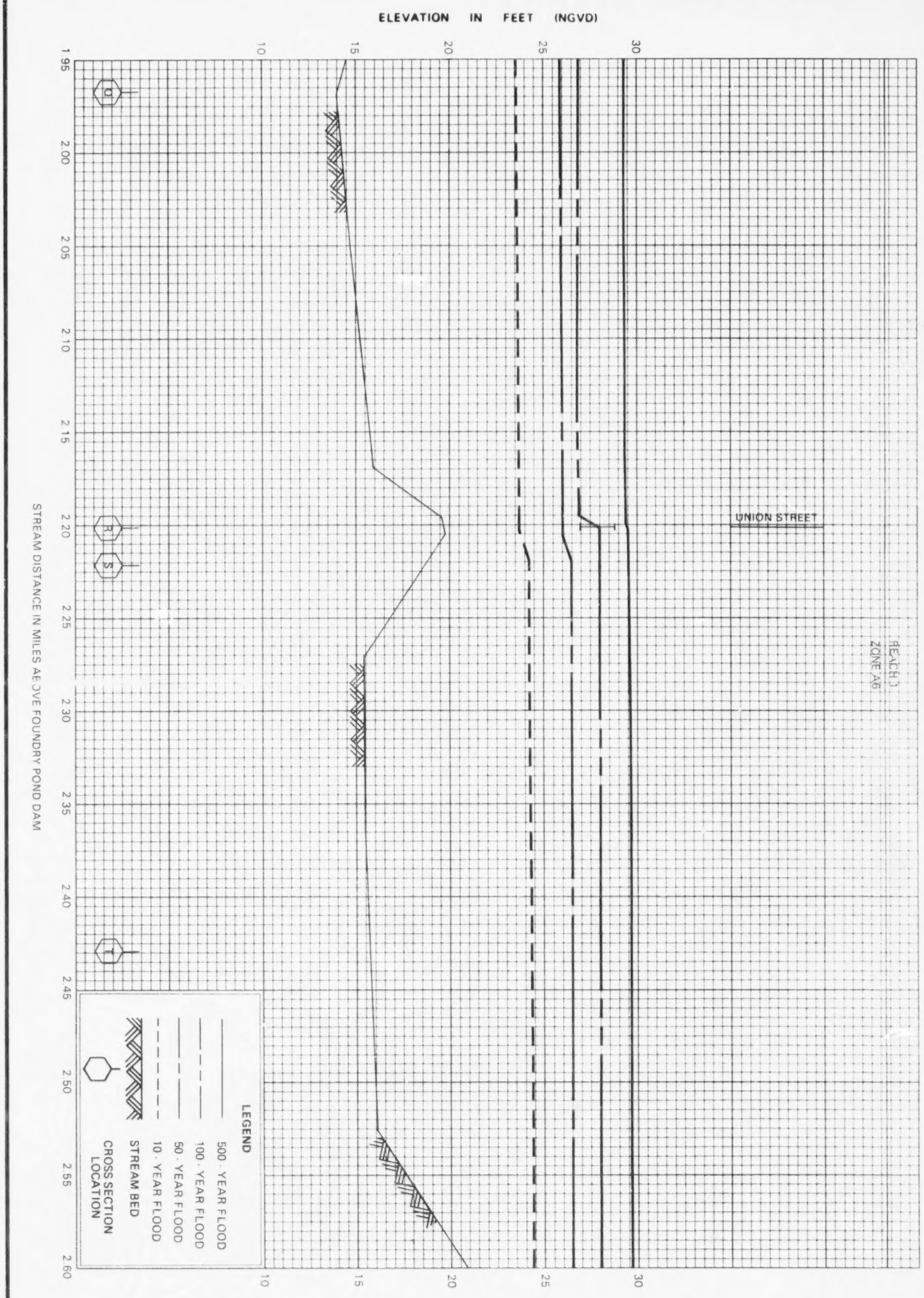


04P

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

FLOOD PROFILES

WEIR RIVER

ELEVATION IN FEET (NGVD)

15 20 25 30 35

STREAM DISTANCE IN MILES ABOVE FOUNDRY POND DAM

2 60 2 65 2 70 2 75 2 80 2 85 2 90 2 95 3 00 3 05 3 10 3 15 3 20 3 25

WEIR RIVER

CROOKED MEADOW RIVER

FREE STREET

ZONE A6

REACH 1

REACH 1

ZONE A5

STATE ROUTE 228

U

V

W

X

Y

LEGEND

500 - YEAR FLOOD

100 - YEAR FLOOD

50 - YEAR FLOOD

10 - YEAR FLOOD

STREAM BED

CROSS SECTION LOCATION

15 20 25 30 35

39

05P

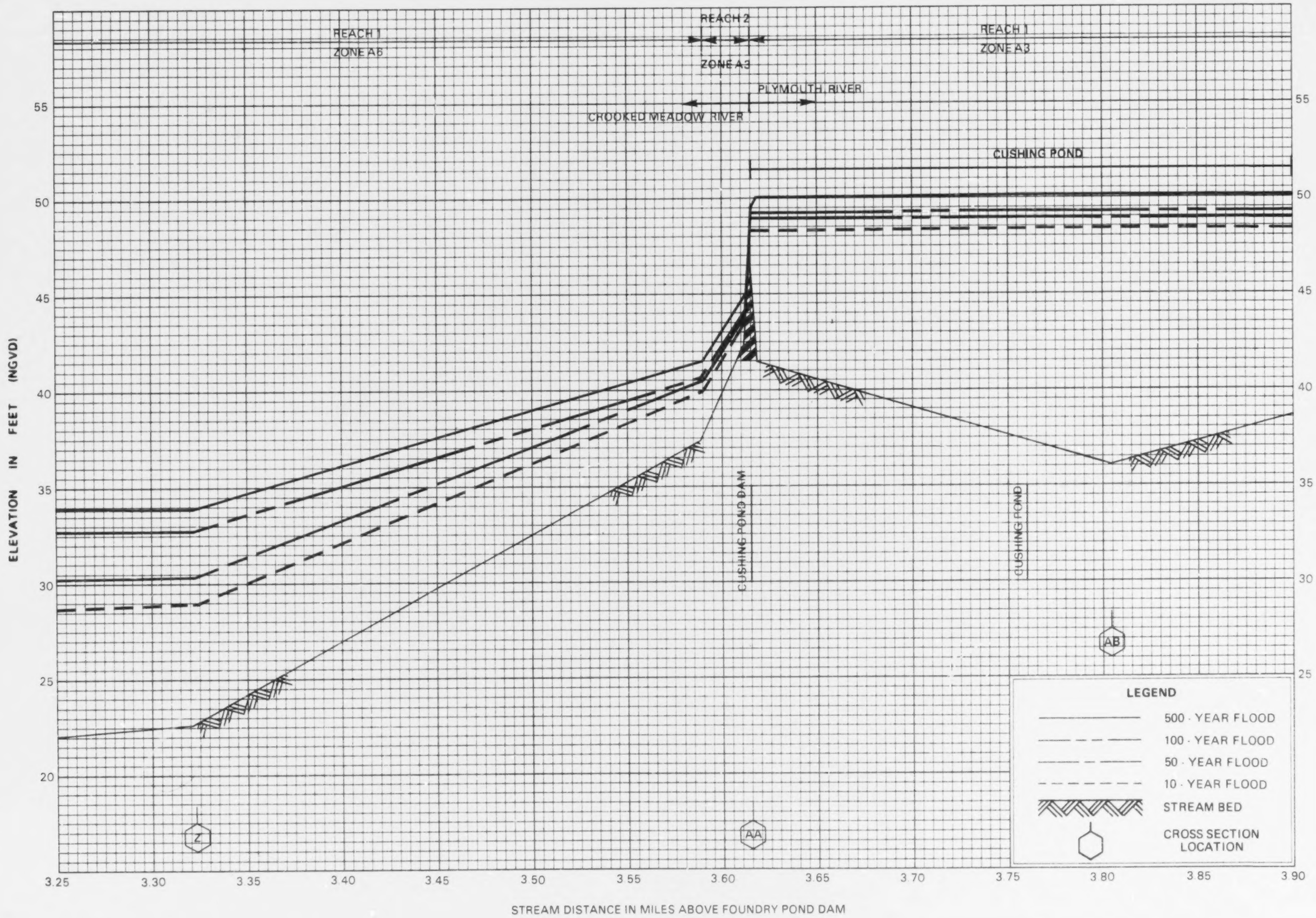
FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

FLOOD PROFILES

WEIR RIVER-CROOKED MEADOW RIVER



FLOOD PROFILES

CROOKED MEADOW RIVER-PLYMOUTH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

06P

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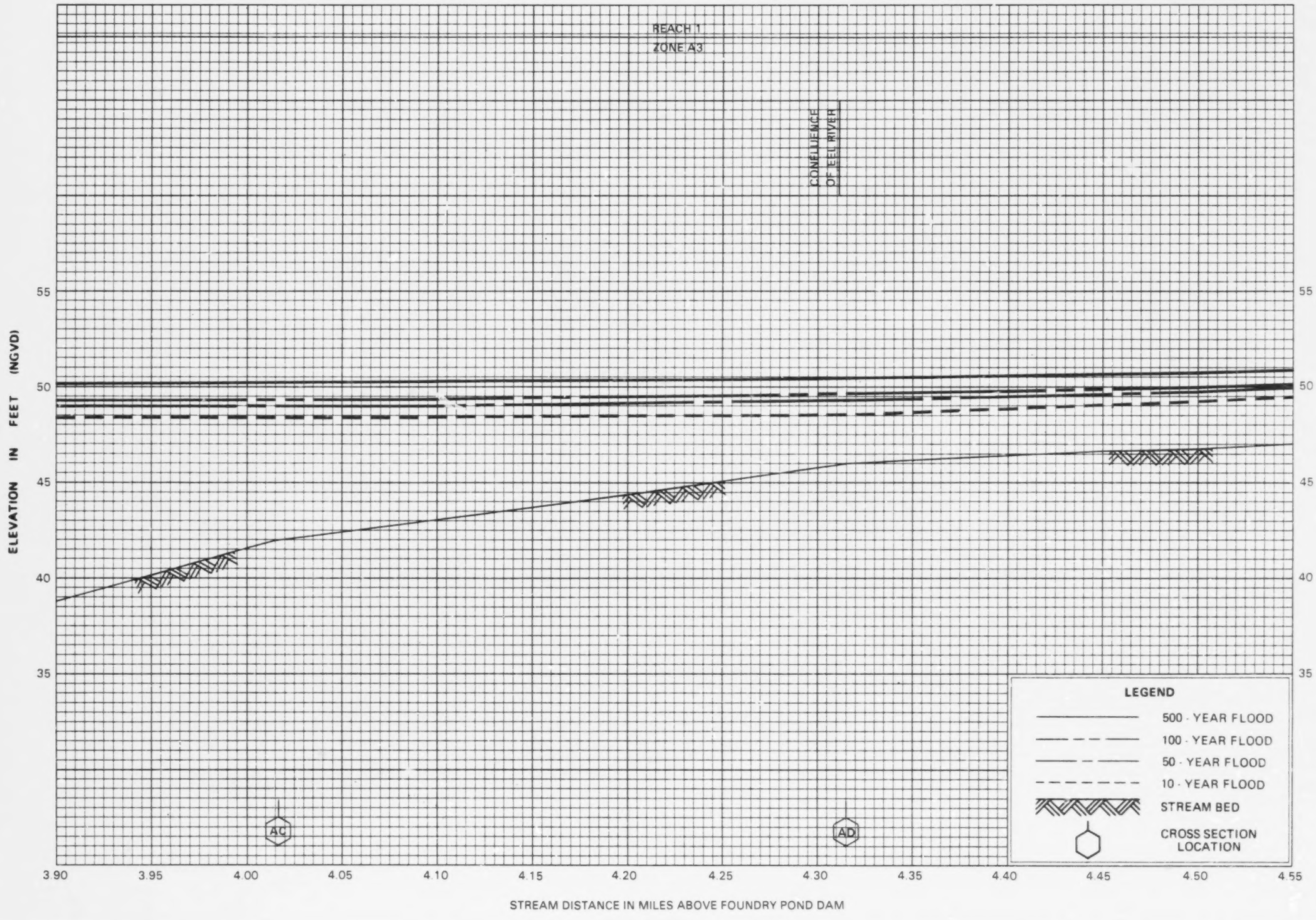

FLOOD PROFILES

PLYMOUTH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

07P

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REACH 1
ZONE A3

WARD STREET

PLYMOUTH RIVER ROAD

ELEVATION IN FEET (NGVD)

60
55
50
45

4.55 4.60 4.65 4.70 4.75 4.80 4.85 4.90 4.95 5.00 5.05 5.10 5.15 5.20

STREAM DISTANCE IN MILES ABOVE FOUNDRY POND DAM

AE AF AG AH AI AJ

LEGEND

- 500 - YEAR FLOOD
- 100 - YEAR FLOOD
- 50 - YEAR FLOOD
- 10 - YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

PLYMOUTH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

08P

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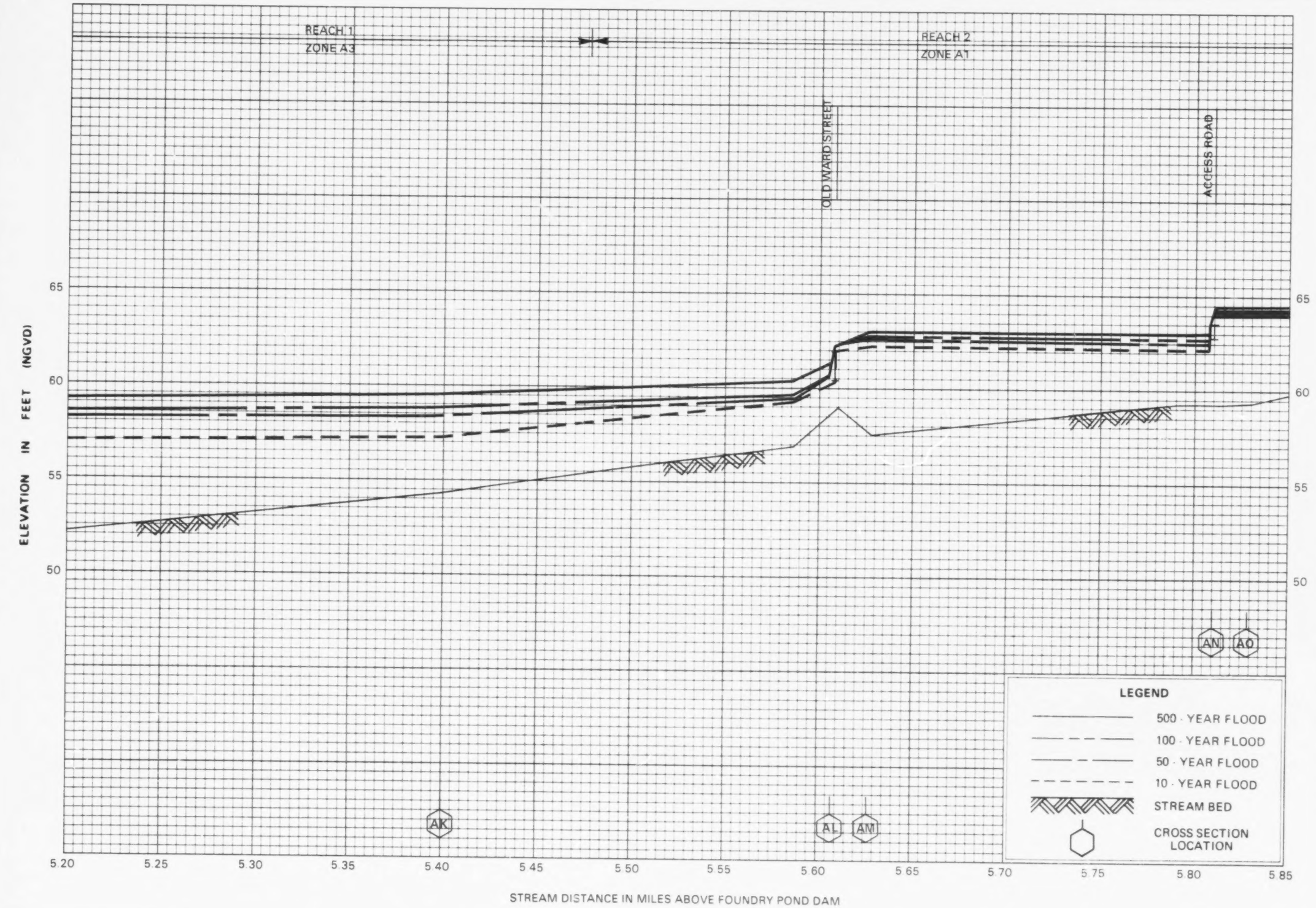

FLOOD PROFILES

PLYMOUTH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

09P

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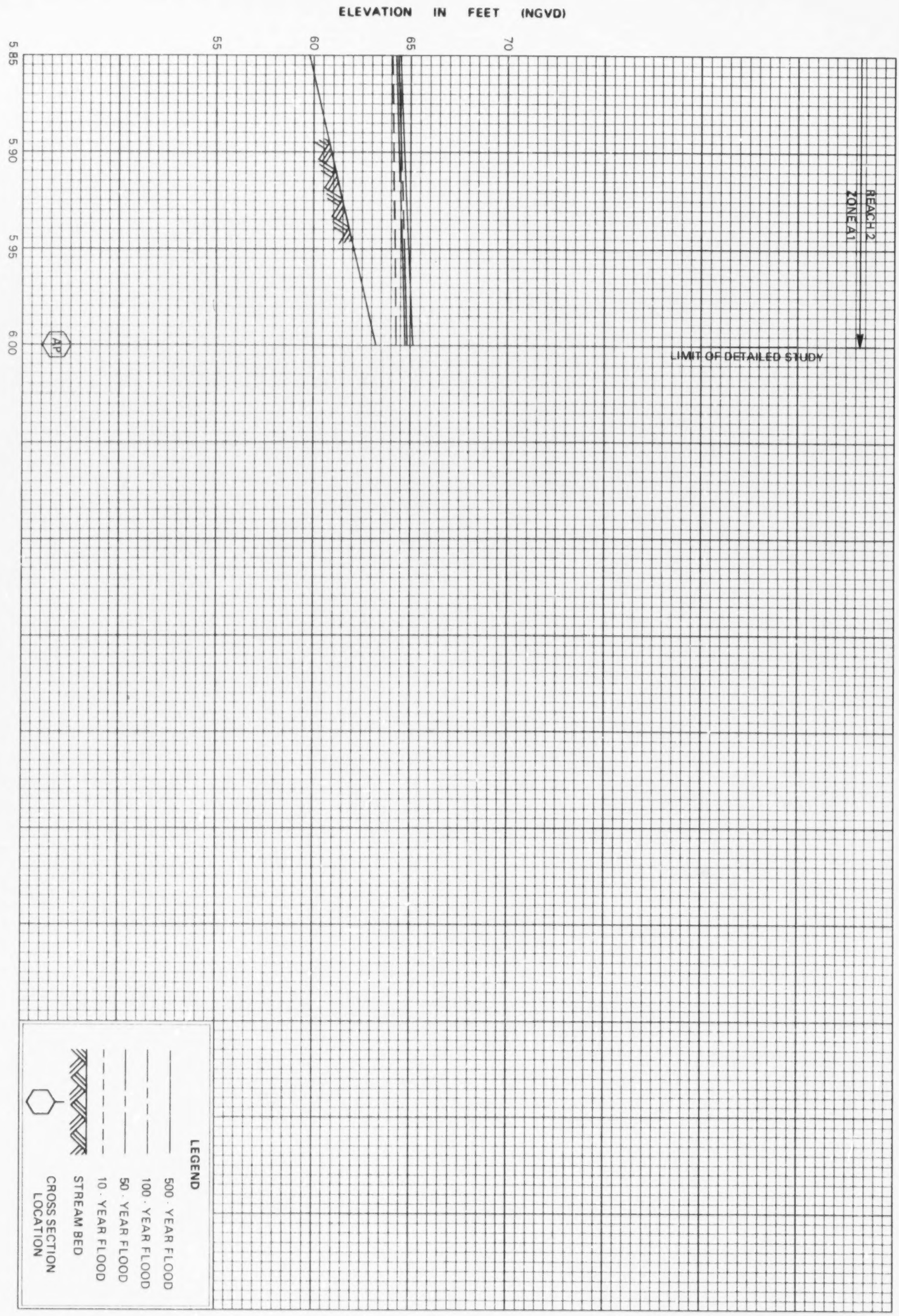

10P

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

FLOOD PROFILES

PLYMOUTH RIVER

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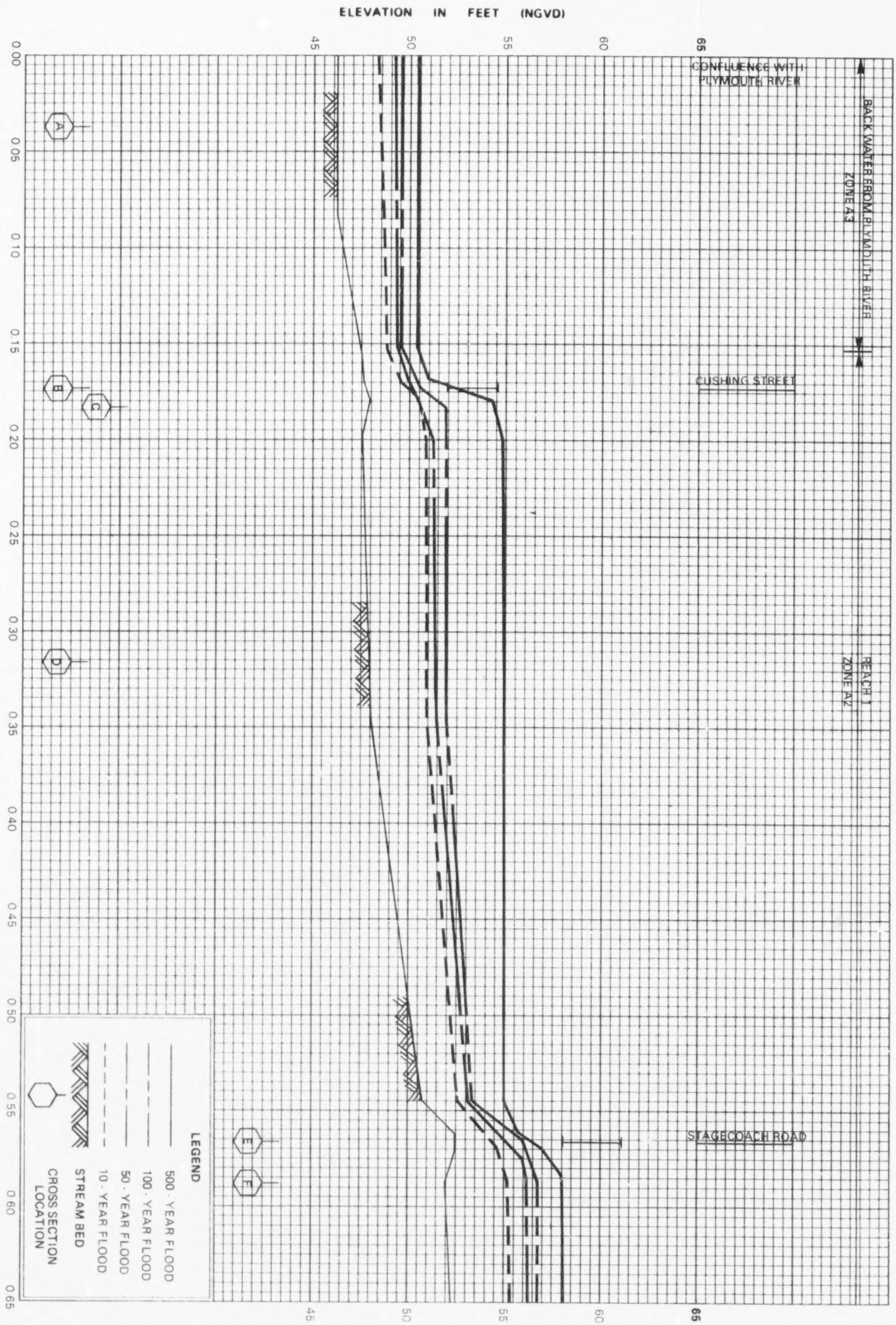
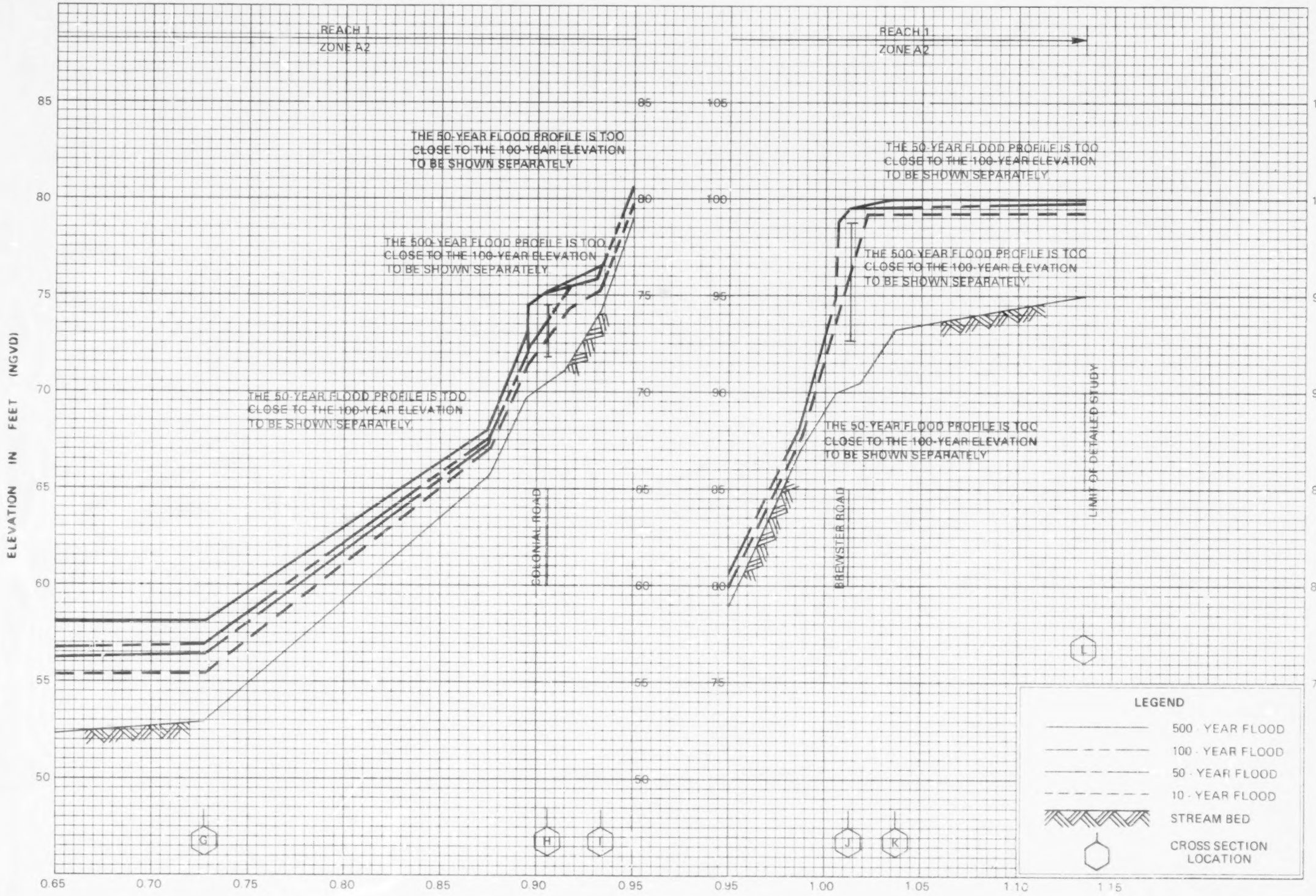


11P	FEDERAL EMERGENCY MANAGEMENT AGENCY TOWN OF HINGHAM, MA (PLYMOUTH CO.)	FLOOD PROFILES EEL RIVER



FLOOD PROFILES

EEL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

12P

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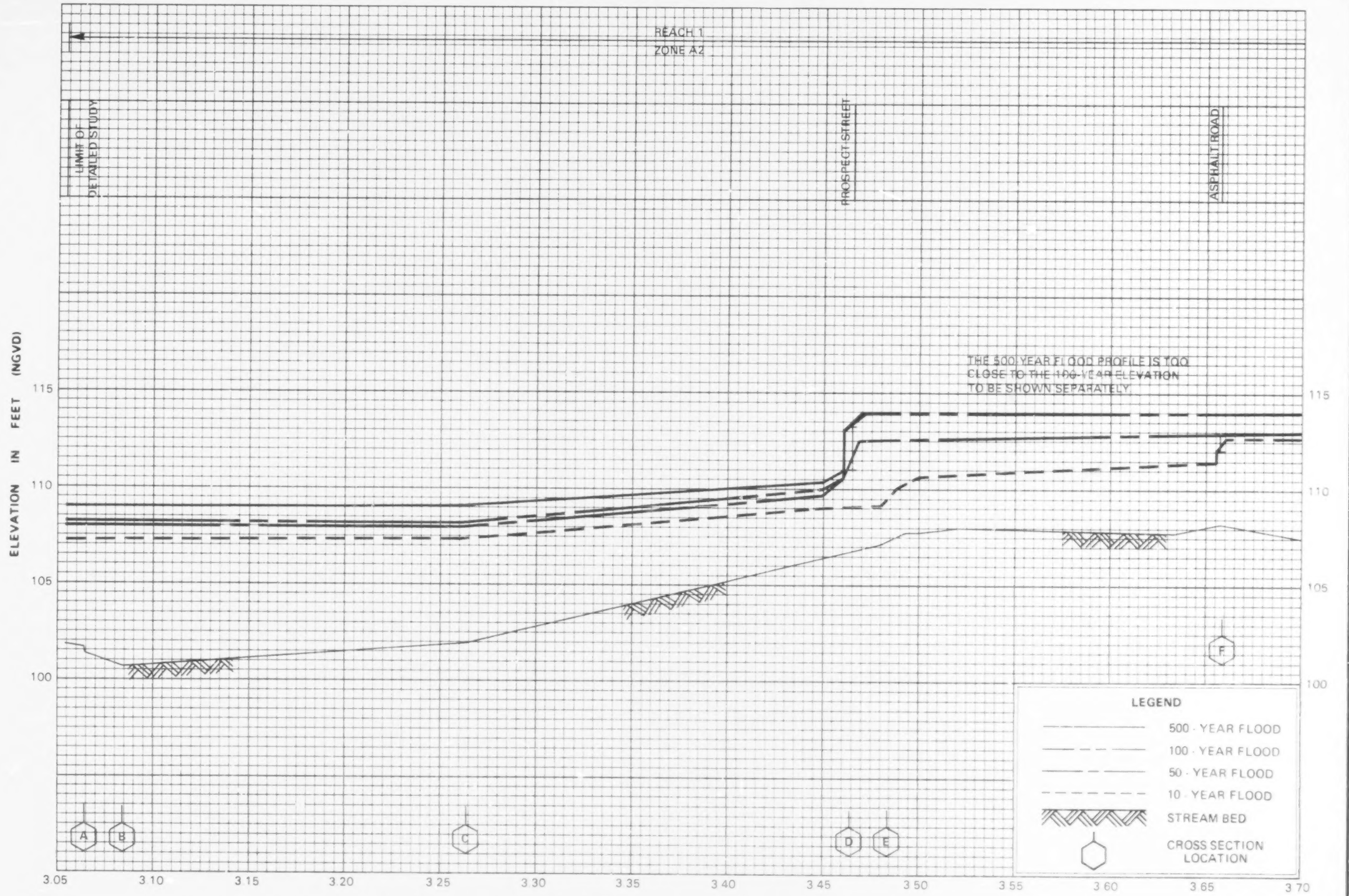

FLOOD PROFILES

ACCORD BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

13P

BEST COPY AVAILABLE

REACH 1
ZONE A2

THE 500-YEAR FLOOD PROFILE IS TOO CLOSE TO THE 100-YEAR ELEVATION TO BE SHOWN SEPARATELY

ELEVATION IN FEET (NGVD)

120
115
110
105

3.70 3.75 3.80 3.85 3.90 3.95 4.00 4.05 4.10 4.15 4.20 4.25 4.30 4.35

STREAM DISTANCE IN MILES ABOVE CONFLUENCE WITH PLYMOUTH RIVER

G H I

LEGEND

- 500 - YEAR FLOOD
- 100 - YEAR FLOOD
- 50 - YEAR FLOOD
- 10 - YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

ACCORD BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

14P

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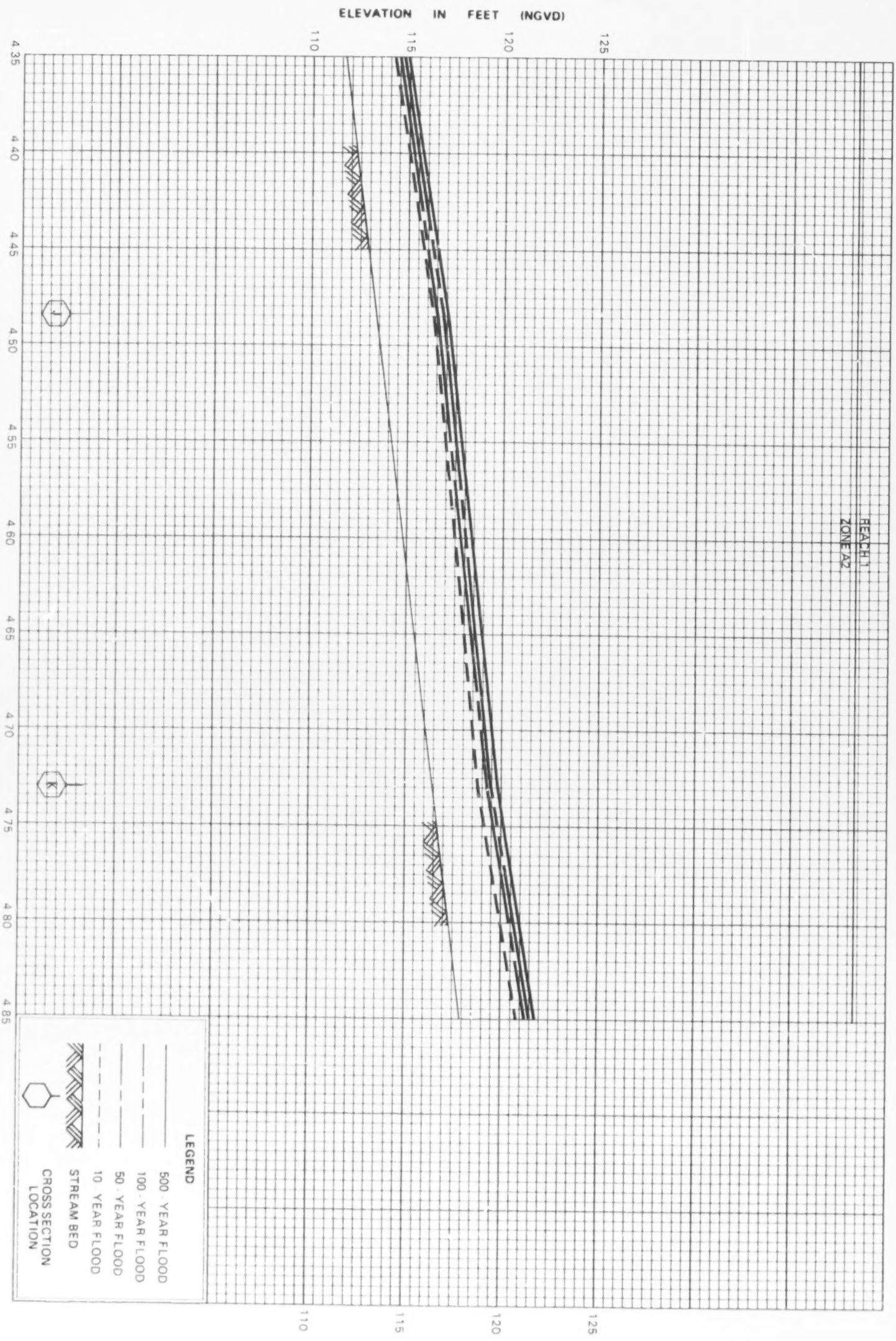
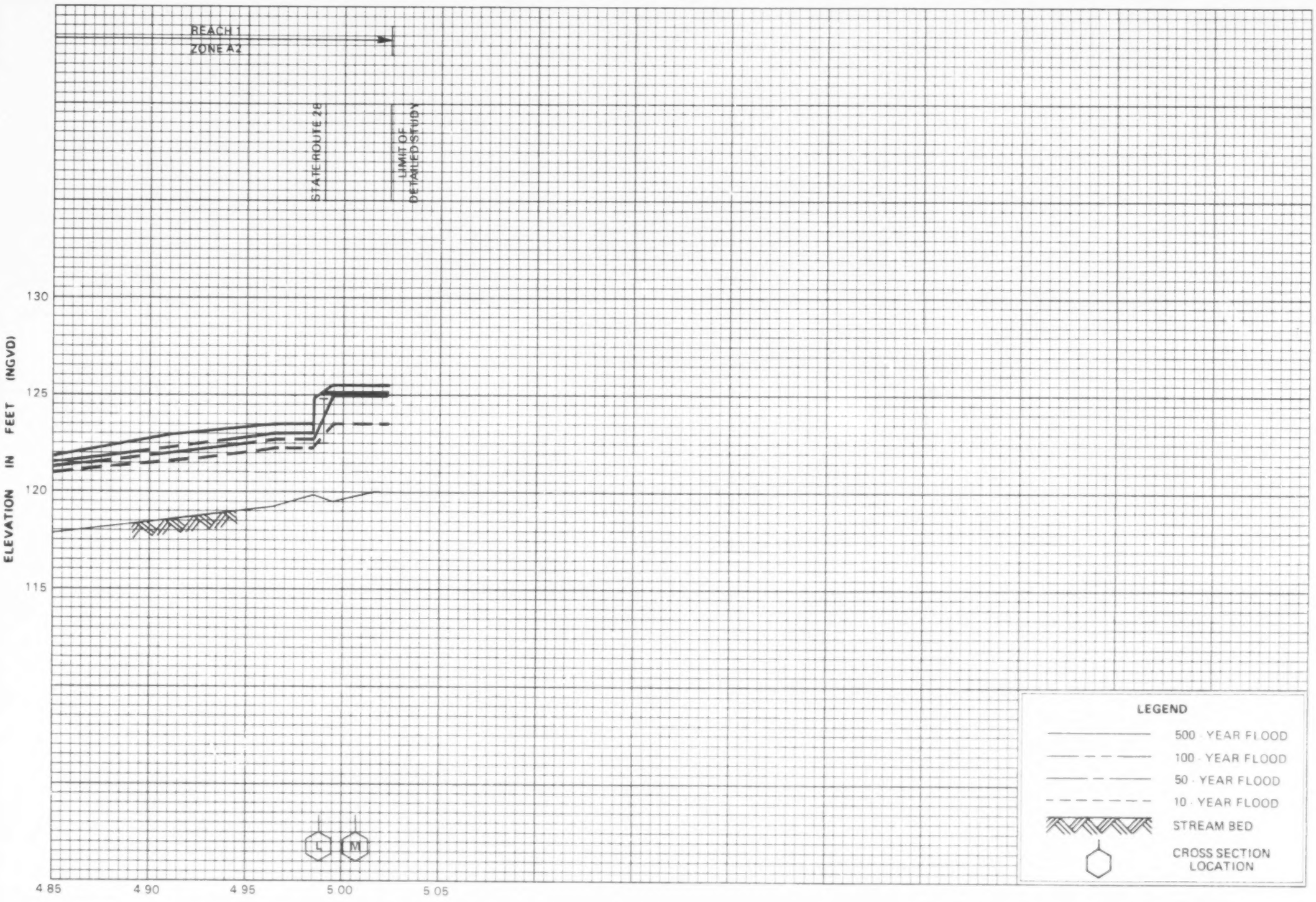


15P	FEDERAL EMERGENCY MANAGEMENT AGENCY TOWN OF HINGHAM, MA (PLYMOUTH CO.)	FLOOD PROFILES ACCORD BROOK



FLOOD PROFILES

ACCORD BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

16P

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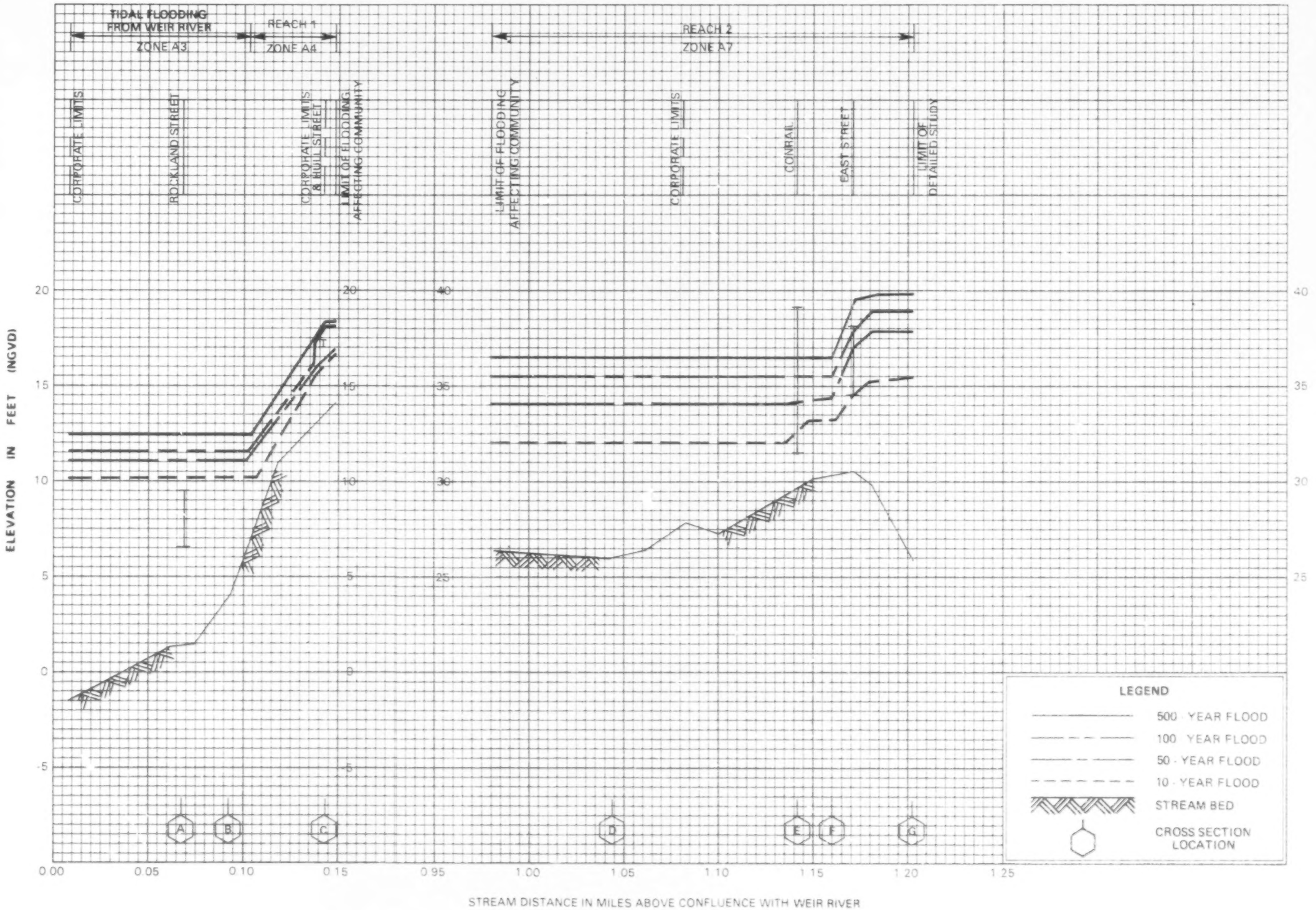

FLOOD PROFILES

TURKEY HILL RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

17P

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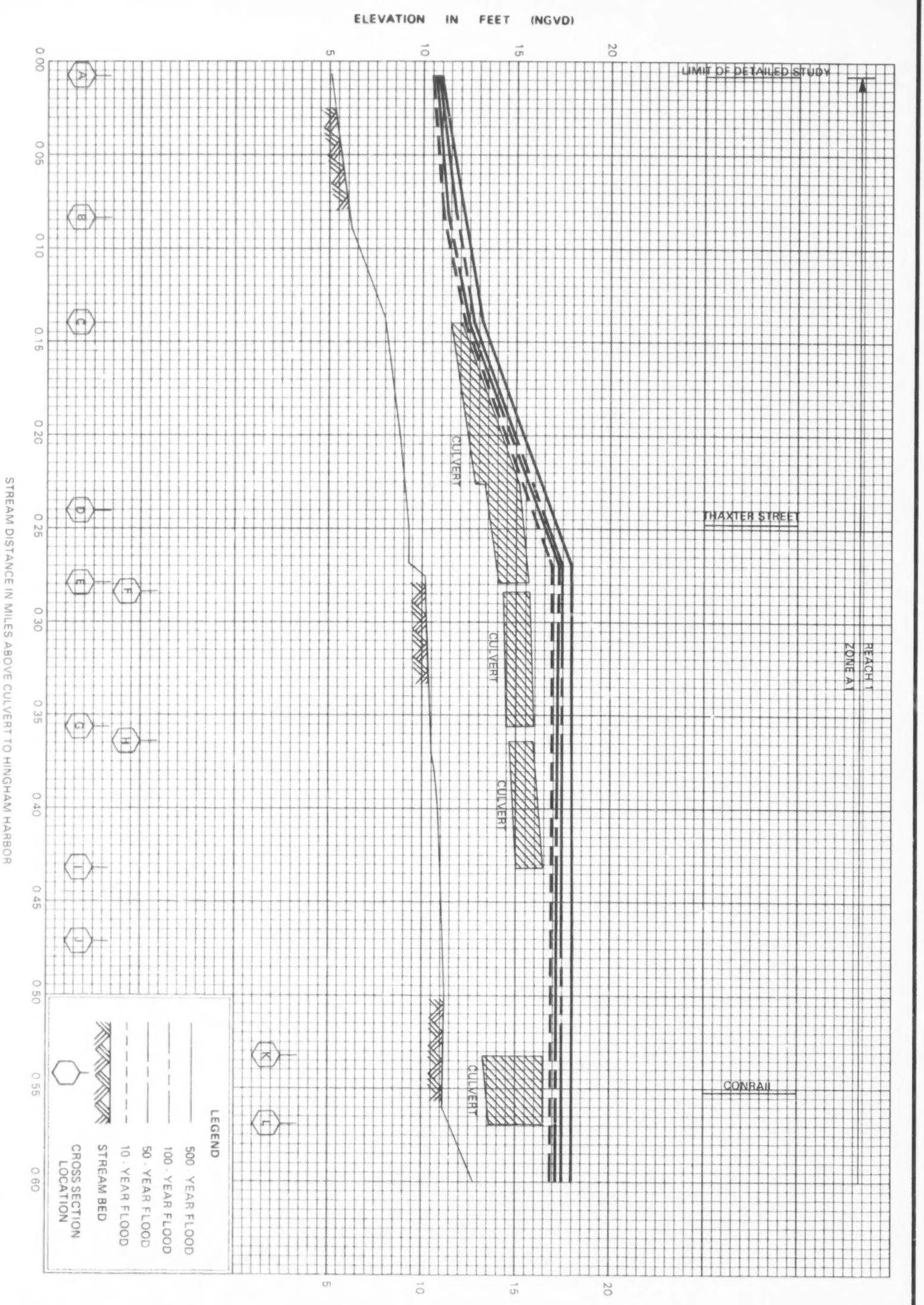

18P	FEDERAL EMERGENCY MANAGEMENT AGENCY TOWN OF HINGHAM, MA (PLYMOUTH CO.)	FLOOD PROFILES TOWN BROOK

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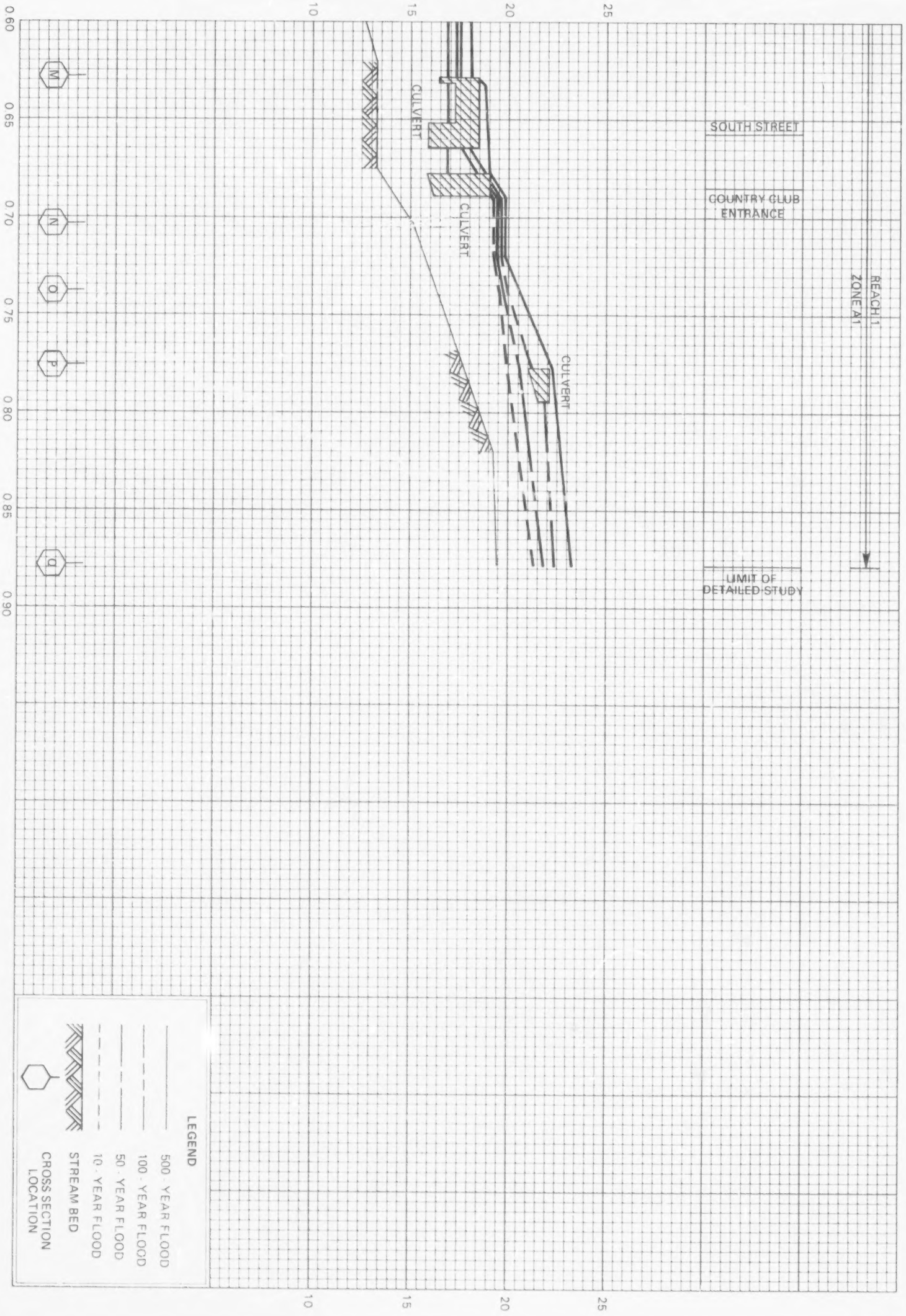
ELEVATION IN FEET (NGVD)



STREAM DISTANCE IN MILES ABOVE CULVERT TO HINGHAM HARBOR

19P	FEDERAL EMERGENCY MANAGEMENT AGENCY TOWN OF HINGHAM, MA (PLYMOUTH CO.)	FLOOD PROFILES TOWN BROOK

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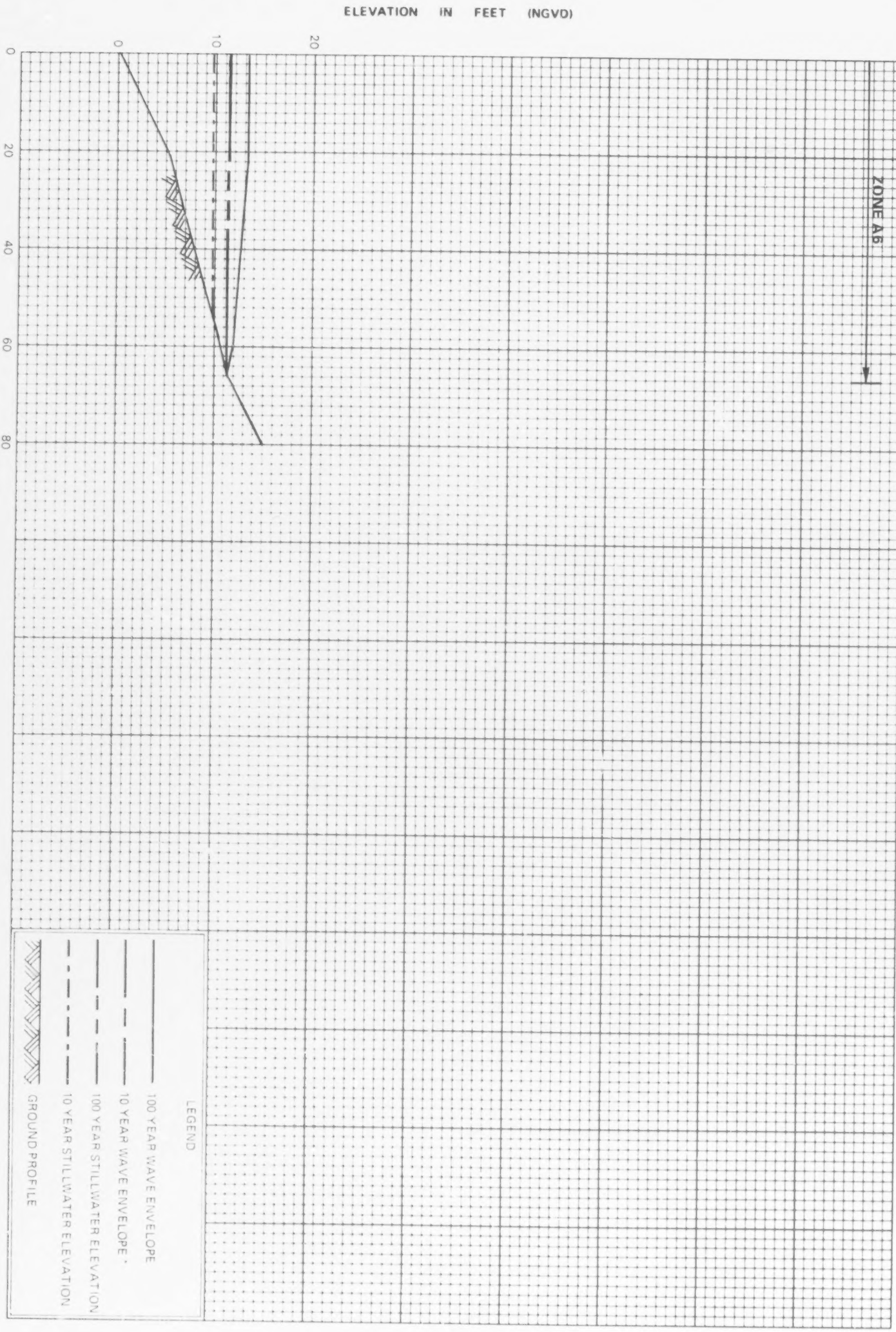
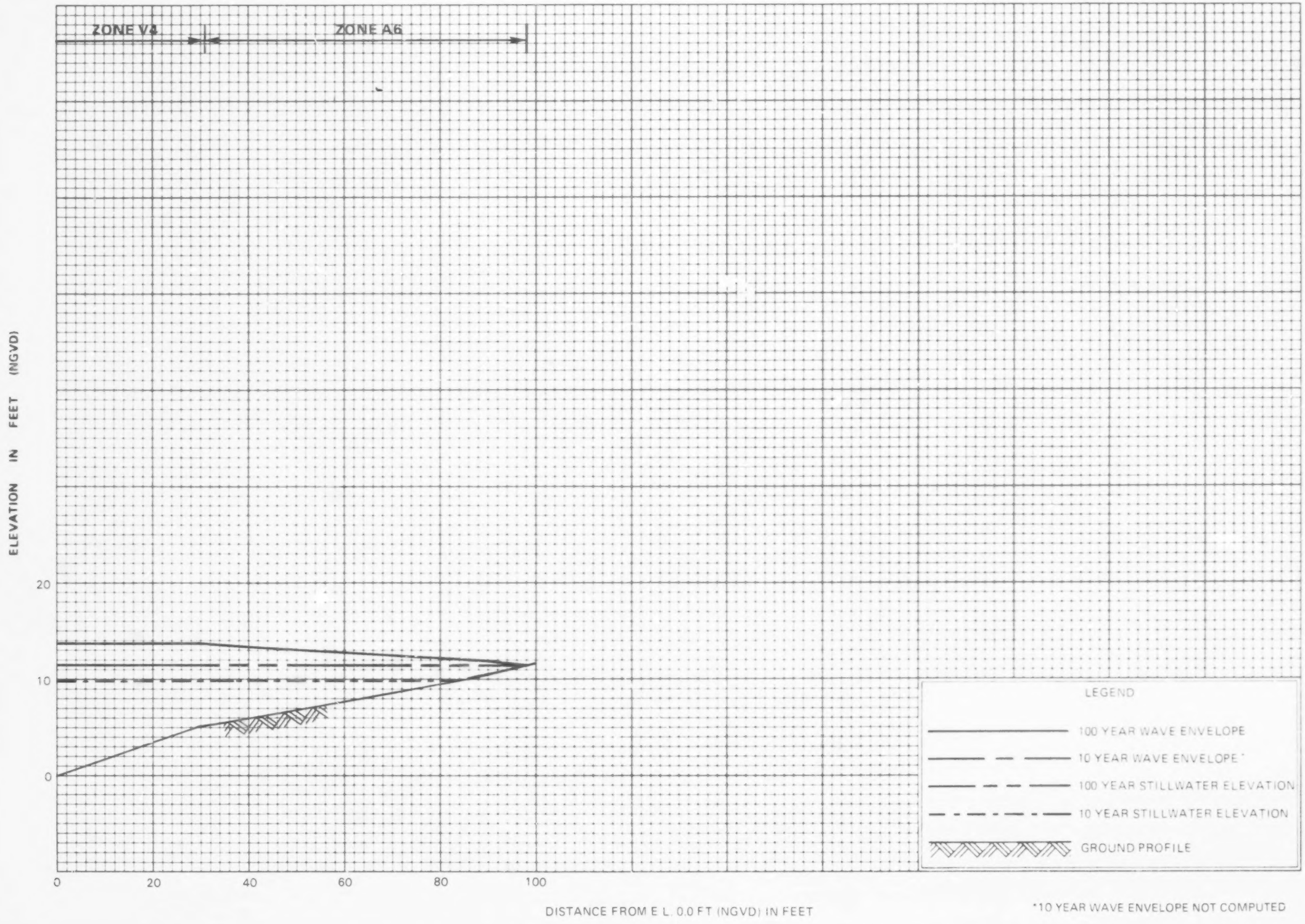


01C	FEDERAL EMERGENCY MANAGEMENT AGENCY TOWN OF HINGHAM, MA (PLYMOUTH CO.)	COASTAL PROFILES TRANSECT NO. 1



COASTAL PROFILES

TRANSECT NO. 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

02C

535

* NOT COPY AVAILABLE

ELEVATION IN FEET (NGVD)

0 10 20

0 20 40 60 80 100 120

DISTANCE FROM E L 0.0 FT (NGVD) IN FEET

ZONE V4

ZONE A5

LEGEND

100 YEAR WAVE ENVELOPE

10 YEAR WAVE ENVELOPE*

100 YEAR STILLWATER ELEVATION

10 YEAR STILLWATER ELEVATION

GROUND PROFILE

*10 YEAR WAVE ENVELOPE NOT COMPUTED

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

COASTAL PROFILES

TRANSECT NO. 3

030

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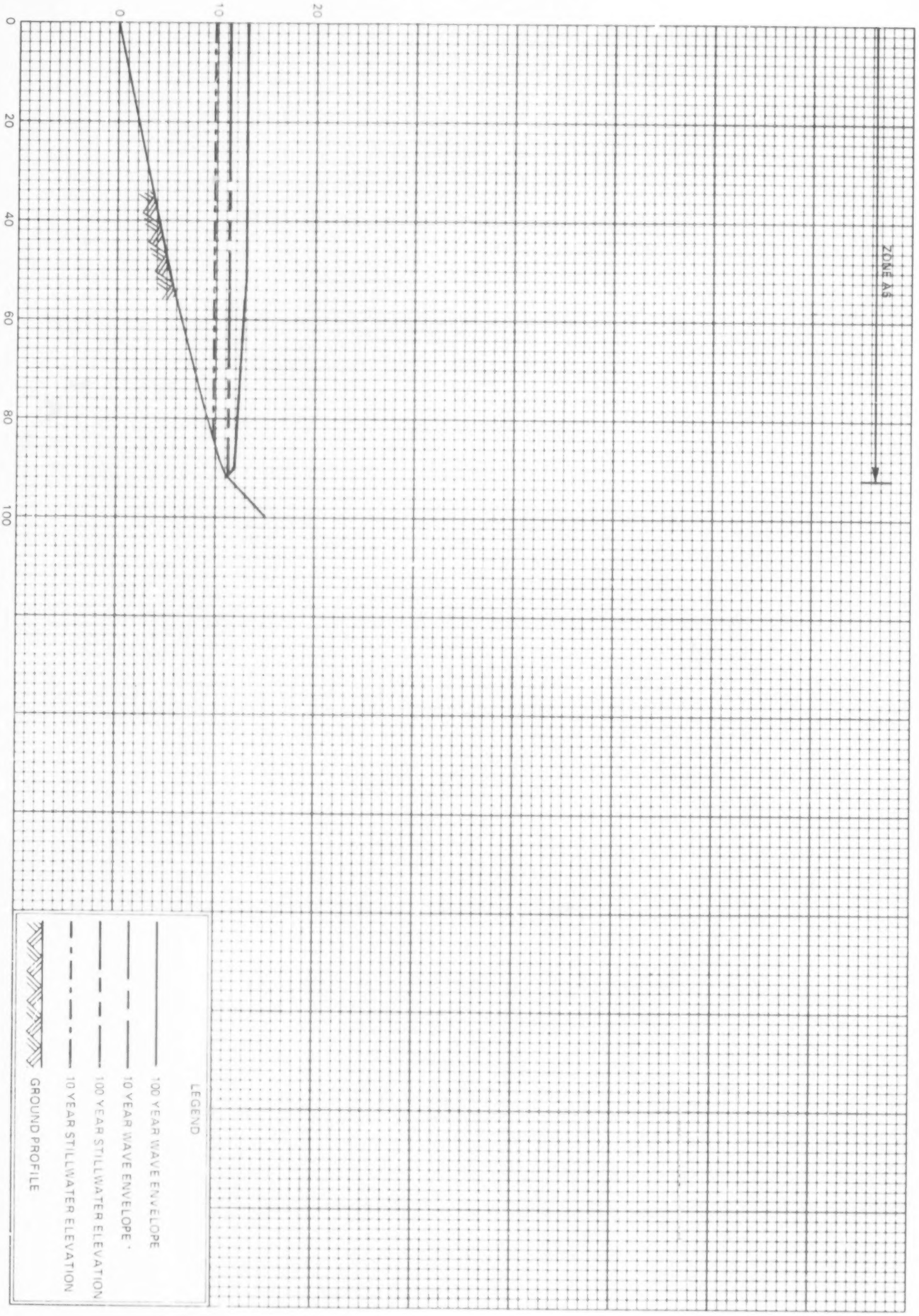
ELEVATION IN FEET (NGVD)



FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

04C

COASTAL PROFILES

TRANSECT NO. 4

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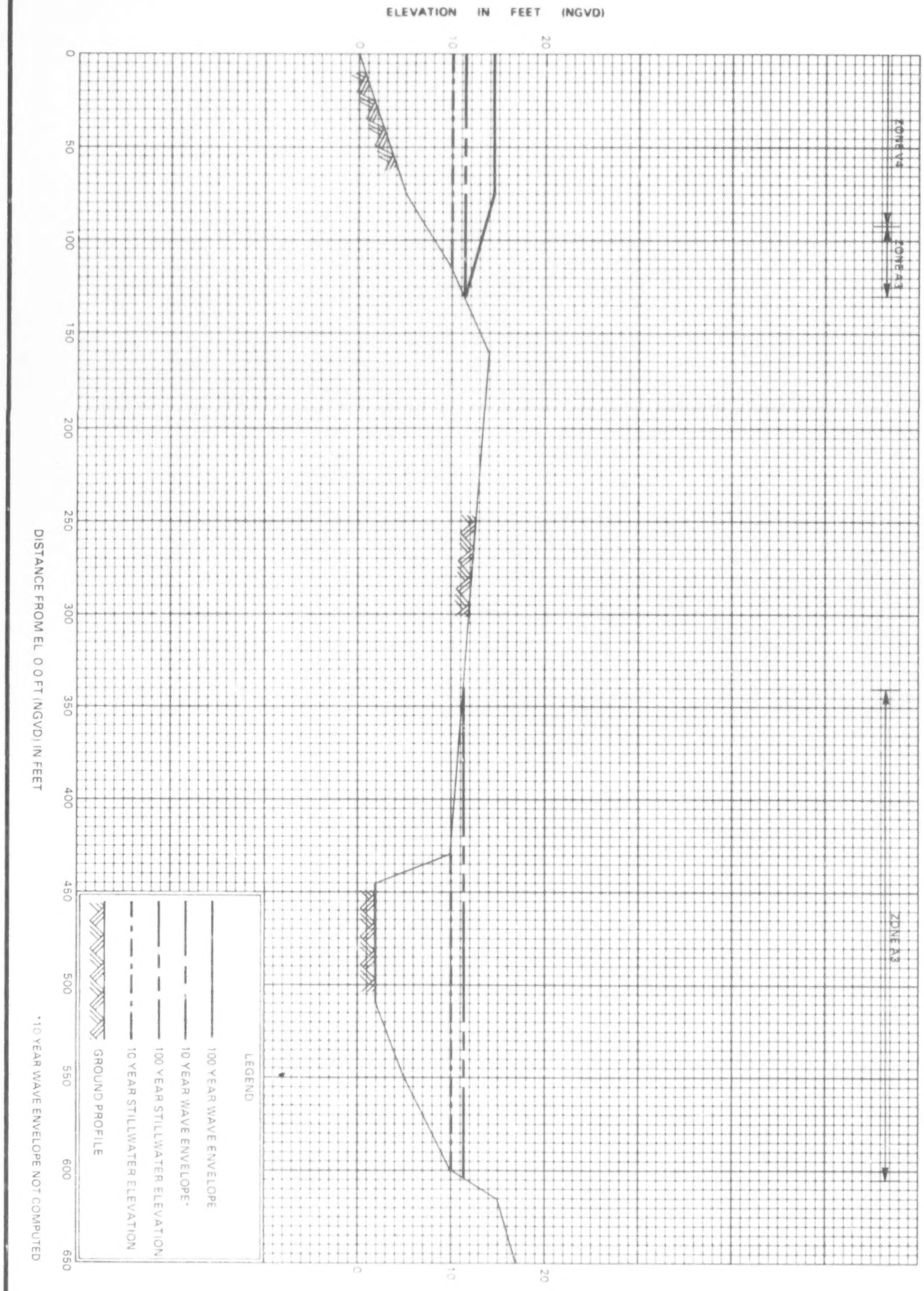

05C	FEDERAL EMERGENCY MANAGEMENT AGENCY TOWN OF HINGHAM, MA (PLYMOUTH CO.)	COASTAL PROFILES TRANSECT NO. 5

58

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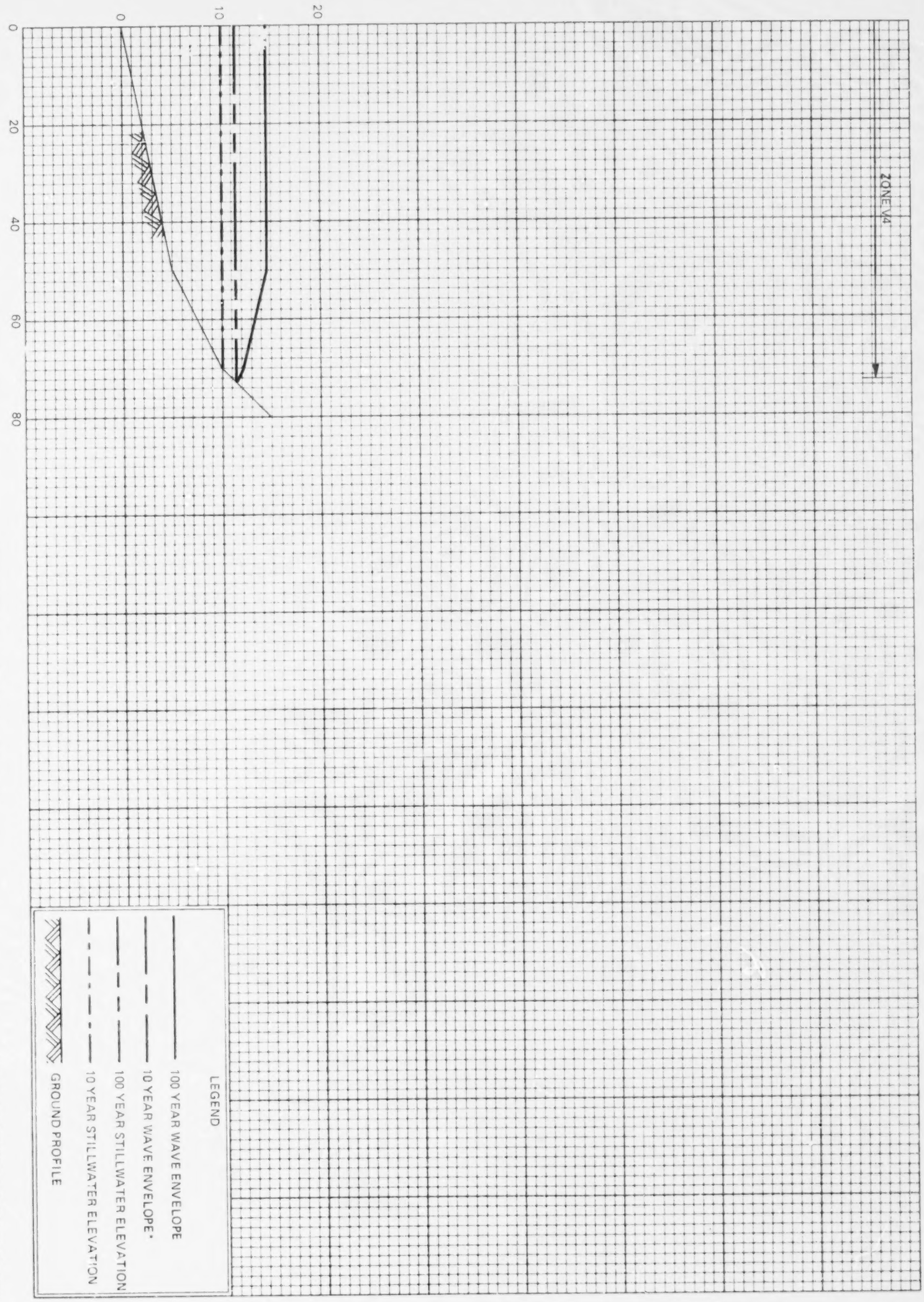
ELEVATION IN FEET (NGVD)



DISTANCE FROM EL 0.0 FT (NGVD) IN FEET

*10 YEAR WAVE ENVELOPE NOT COMPUTED

060

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

COASTAL PROFILES

TRANSECT NO. 6

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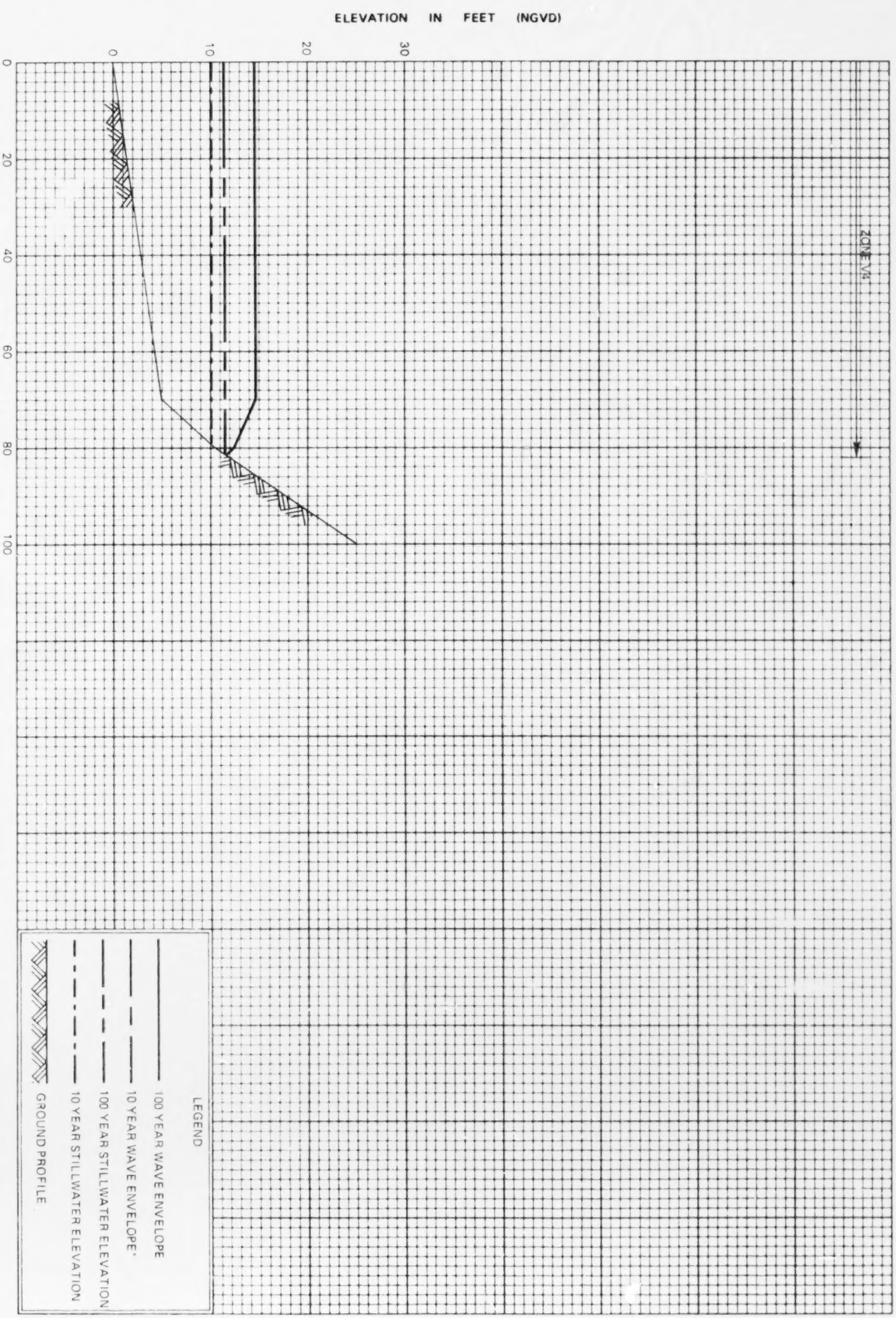


070

FEDERAL EMERGENCY MANAGEMENT AGENCY

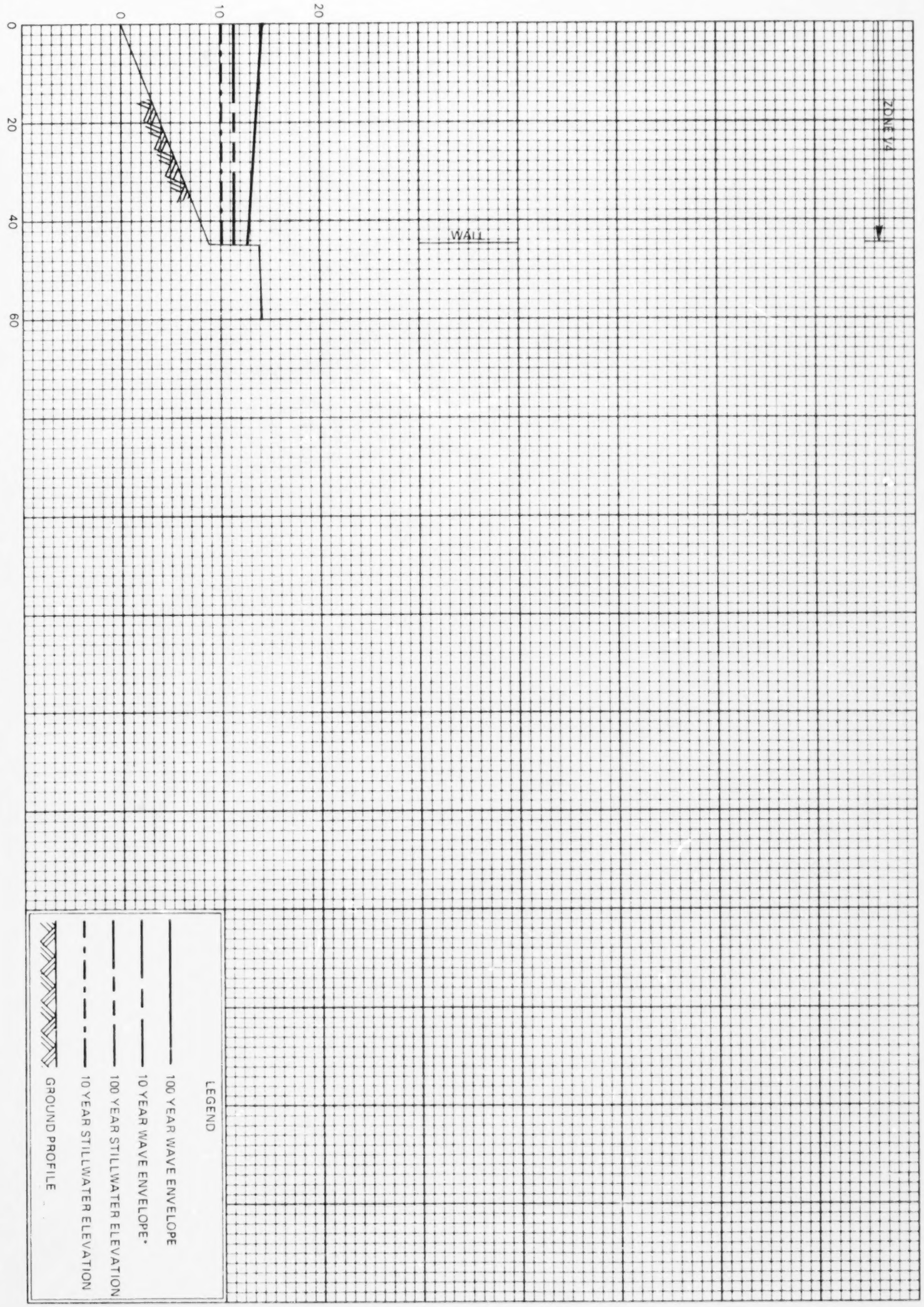
TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

COASTAL PROFILES

TRANSECT NO. 7

ELEVATION IN FEET (NGVD)



DISTANCE FROM EL 0.0 FT (NGVD) IN FEET

*10 YEAR WAVE ENVELOPE NOT COMPUTED

08C

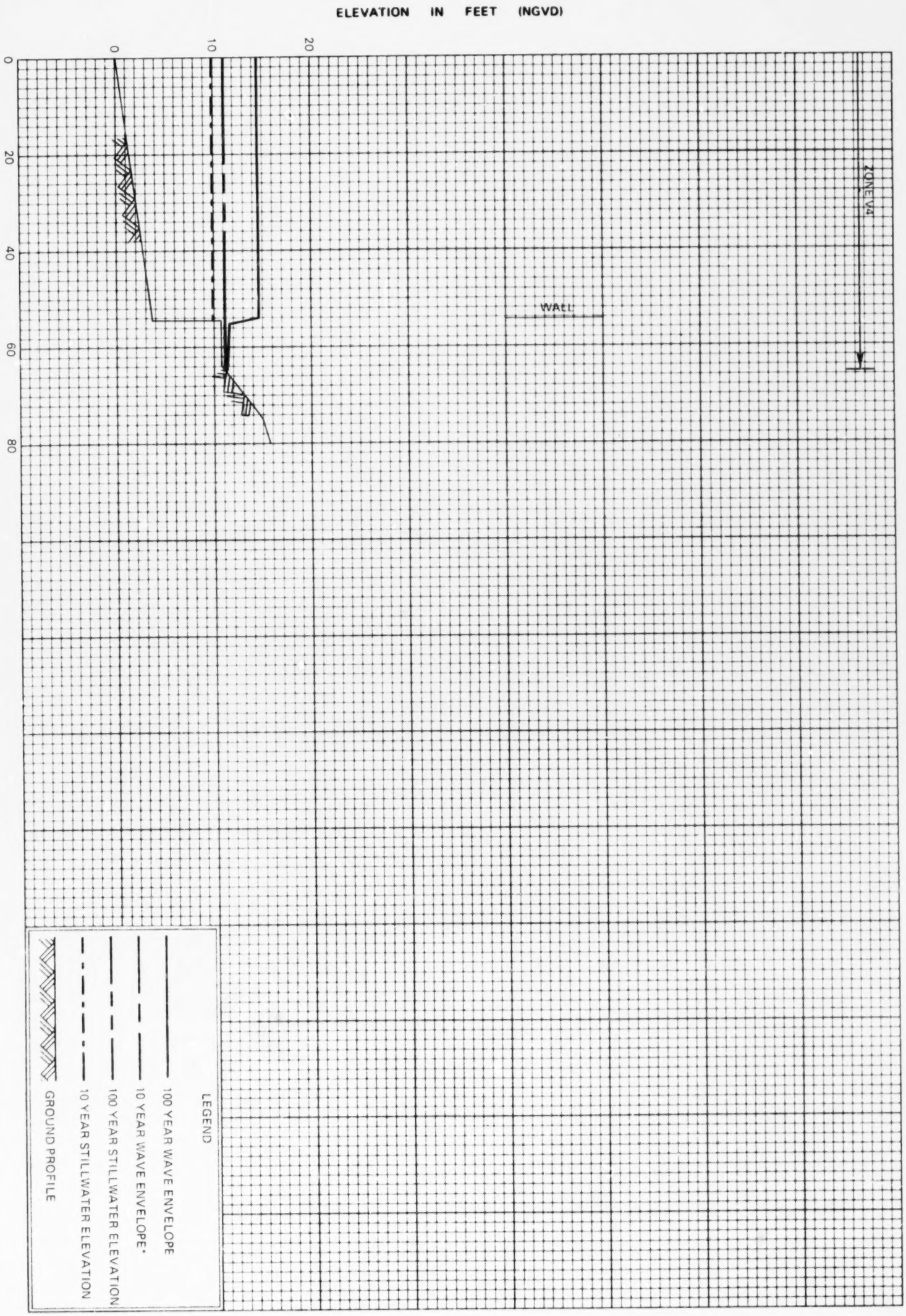
FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

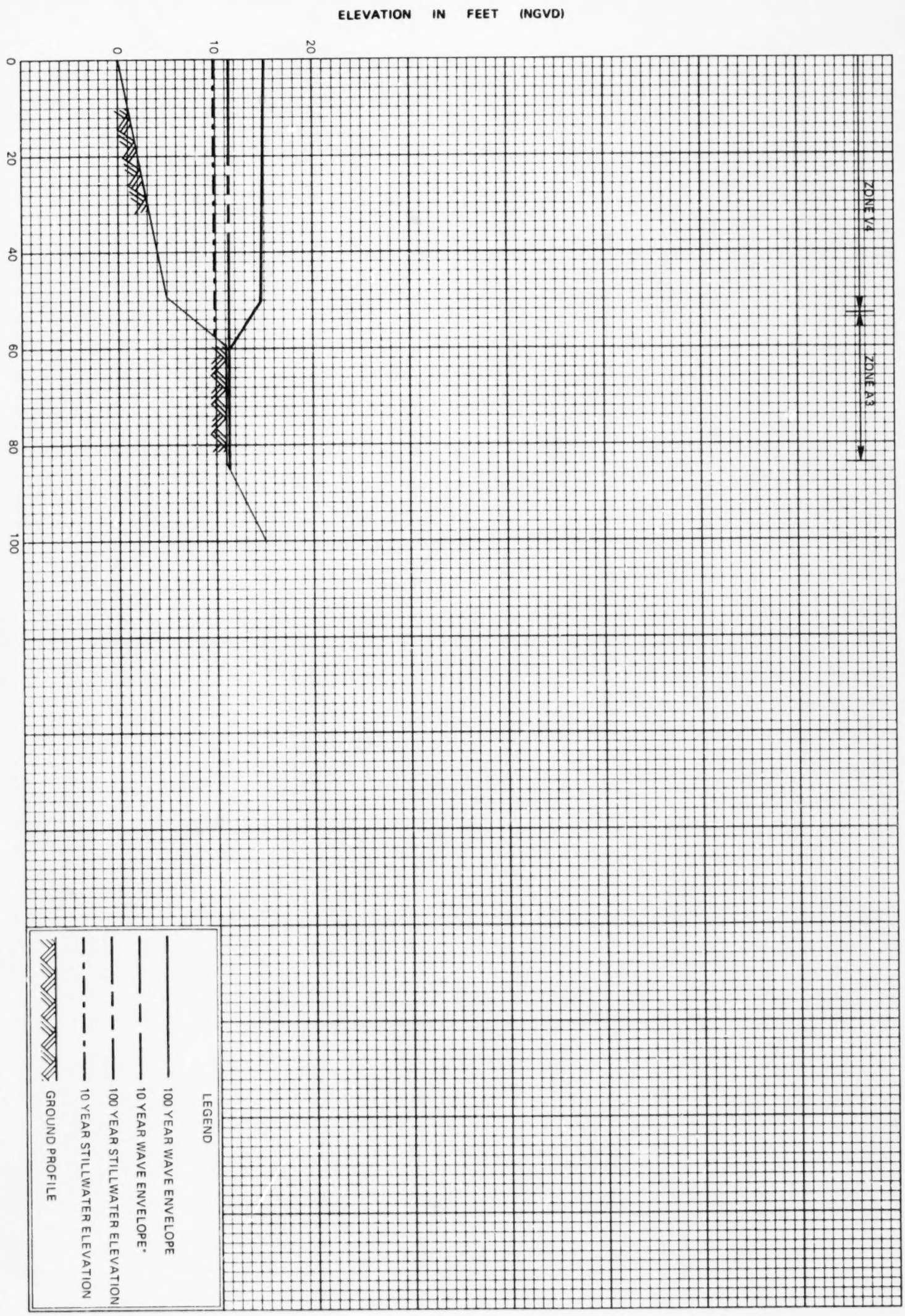
(PLYMOUTH CO.)

COASTAL PROFILES

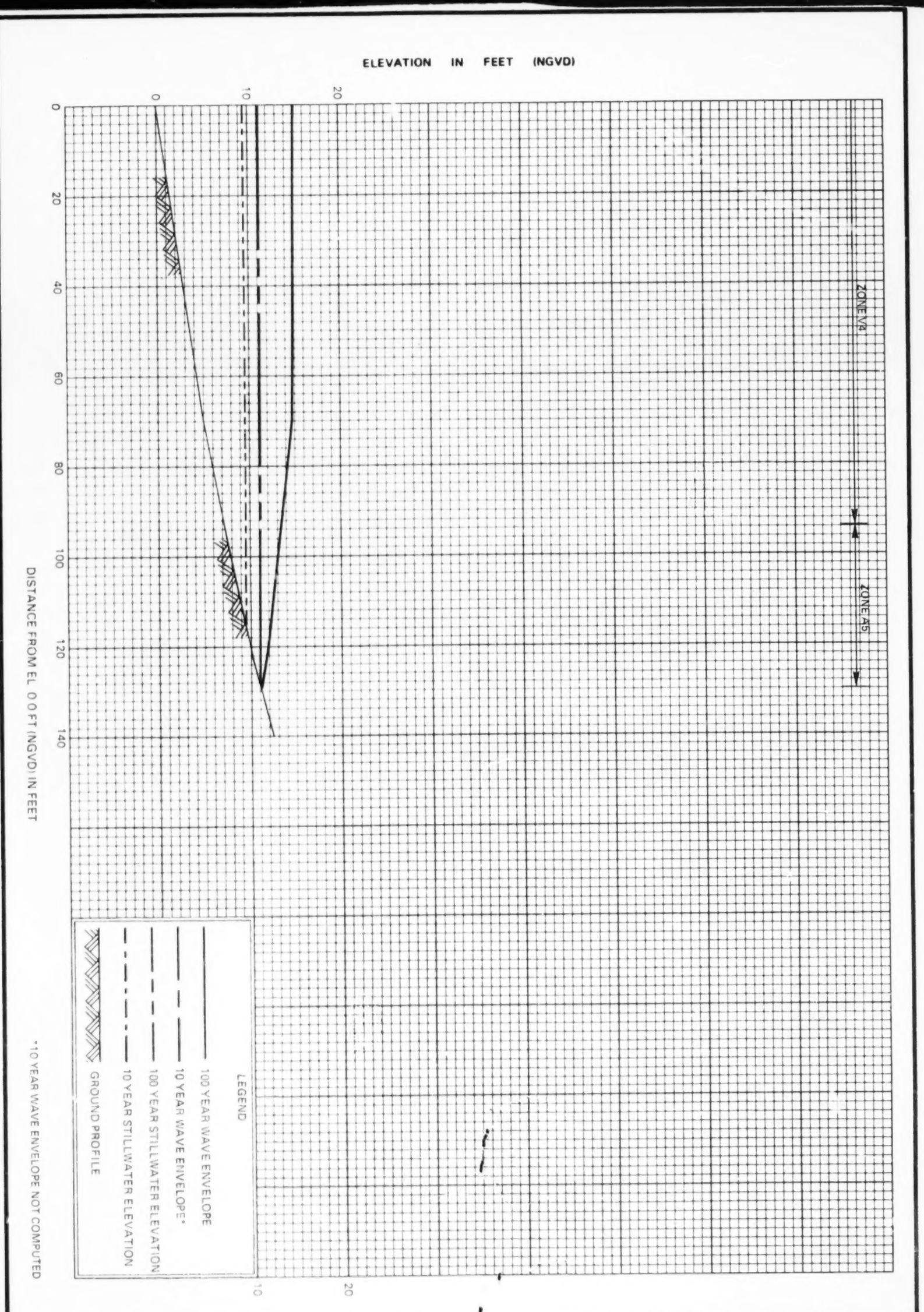
TRANSECT NO. 8



060	FEDERAL EMERGENCY MANAGEMENT AGENCY TOWN OF HINGHAM, MA (PLYMOUTH CO.)	COASTAL PROFILES TRANSECT NO. 9



10C	FEDERAL EMERGENCY MANAGEMENT AGENCY TOWN OF HINGHAM, MA (PLYMOUTH CO.)	COASTAL PROFILES TRANSECT NO. 10



FEDERAL EMERGENCY MANAGEMENT AGENCY

11C

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

COASTAL PROFILES

TRANSECT NO. 11

ELEVATION IN FEET (NGVD)

0 10 20

0 50 100 150

ZONE AE

DISTANCE FROM EL 0.0 FT (NGVD) IN FEET

*10 YEAR WAVE ENVELOPE NOT COMPUTED

LEGEND

- 100 YEAR WAVE ENVELOPE
- 10 YEAR WAVE ENVELOPE*
- 100 YEAR STILLWATER ELEVATION
- 10 YEAR STILLWATER ELEVATION
- GROUND PROFILE

12C

FEDERAL EMERGENCY MANAGEMENT AGENCY

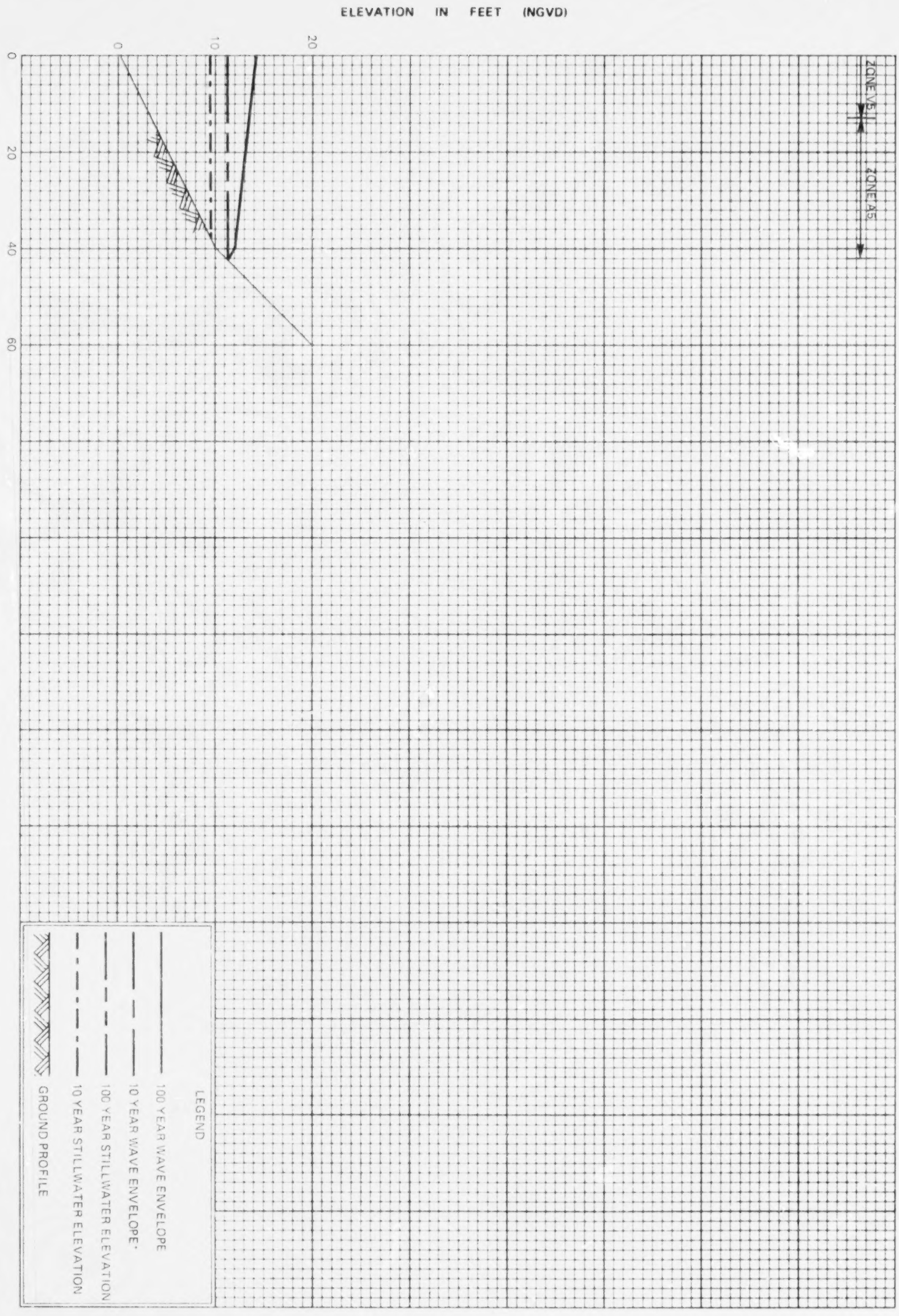
TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

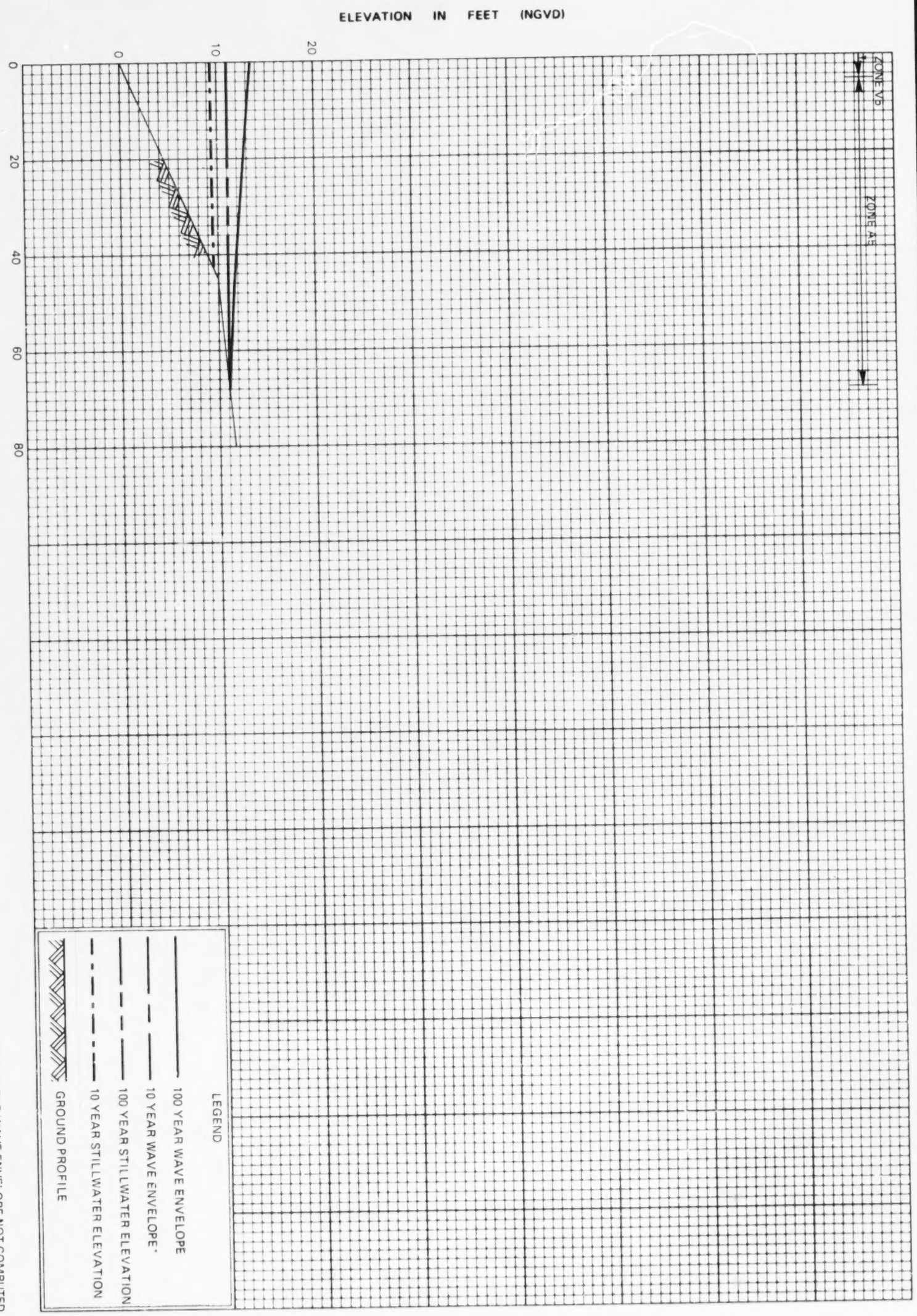
COASTAL PROFILES

TRANSECT NO. 12

BEST COPY AVAILABLE



13C	FEDERAL EMERGENCY MANAGEMENT AGENCY TOWN OF HINGHAM, MA (PLYMOUTH CO.)	COASTAL PROFILES TRANSECT NO. 13



14C	FEDERAL EMERGENCY MANAGEMENT AGENCY TOWN OF HINGHAM, MA (PLYMOUTH CO.)	COASTAL PROFILES TRANSECT NO. 14

ELEVATION IN FEET (NGVD)

0 10 20

0 20 40 60 80 100 120

ZONE V5

ZONE A5

DISTANCE FROM EL 0.0 FT (NGVD) IN FEET

* 10 YEAR WAVE ENVELOPE NOT COMPUTED

LEGEND

- 100 YEAR WAVE ENVELOPE
- 10 YEAR WAVE ENVELOPE*
- 100 YEAR STILLWATER ELEVATION
- 10 YEAR STILLWATER ELEVATION
- GROUND PROFILE

15C

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF HINGHAM, MA

(PLYMOUTH CO.)

COASTAL PROFILES

TRANSECT NO. 15

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